SEPTEMBER 1954

Power Engineering

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Circulation of this Issue 34,625

Keeping pace with modern

These two Elliott turbine-generator units are located in an interesting new central station which was completed at a station cost of $139 per kw! The turbines operate on steam at 850 psi, 900°F. Both machines are base loaded, part of the power production being used for a local distribution system and the surplus sold as block power through a transmission interchange.

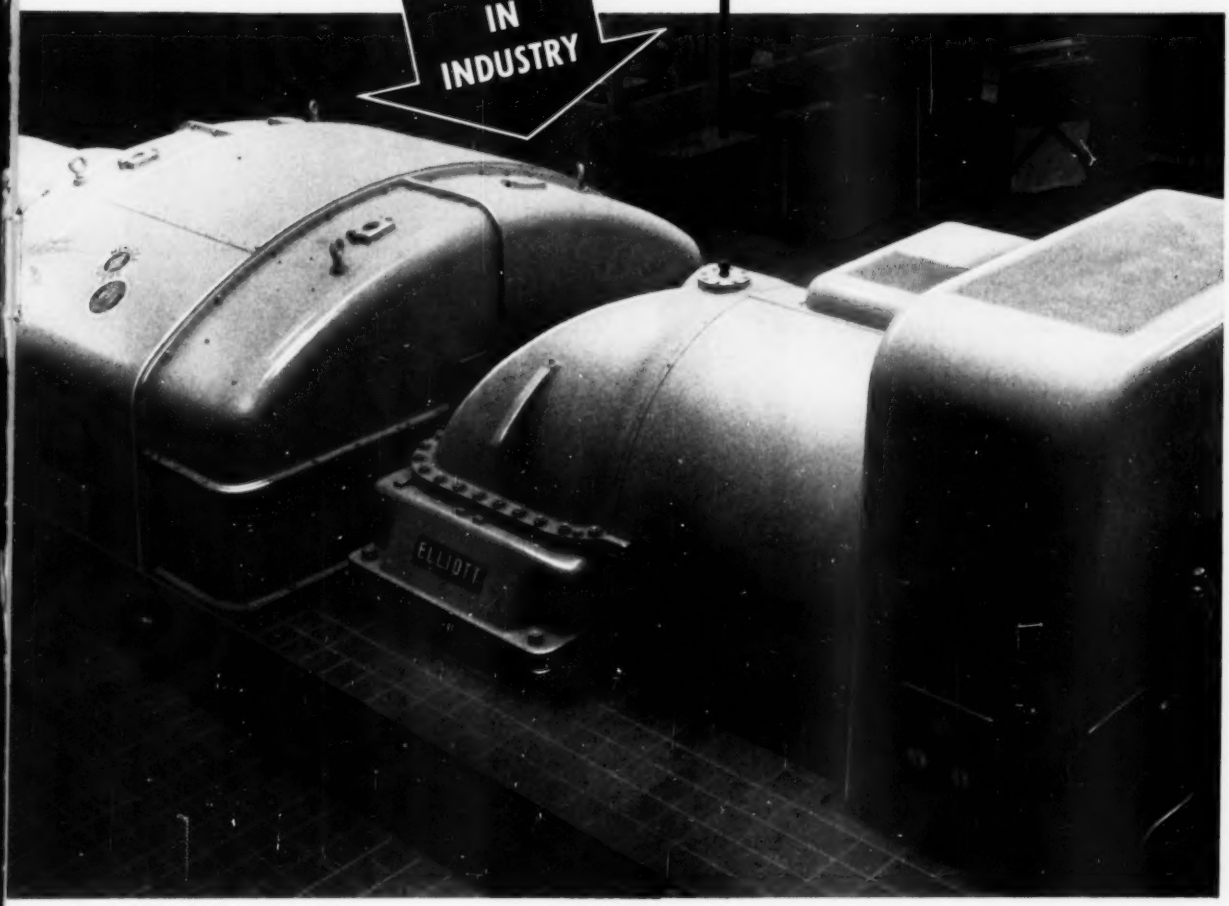
ELLIOTT TURBINE-GENERATORS

H4-5

requirements

IN INDUSTRY

This Elliott turbine-generator unit serves an industrial power plant. It extracts steam for process at 30 psig, being supplied with 400 psig, 700°F steam. This unit is an extension to an existing industrial power plant served by an Elliott back-pressure extraction unit.



ELLIOTT TURBINE-GENERATORS meet the requirements for efficient power generation in utility stations, and the balanced power and process steam requirements of industrial plants. Their modern appearance is indicative of their sound design and superior performance. Both the steam and electrical elements are made by Elliott and the result is a coordinated unit, specifically designed to the individual needs of the plant or station.

New Engineering Bulletin...

"Fundamentals of Turbine Speed Control" contains 32 pages of the latest information on this important aspect of turbine design and performance. Write for Bulletin H-21 to the Elliott Company, Steam Turbine Department, Jeannette, Pa.

ELLIOTT Company

TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

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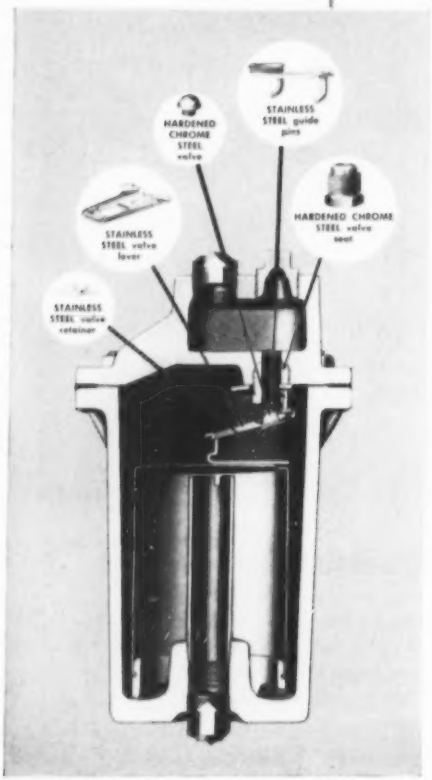
You will always get better results by putting a Steam Trap on each Steam Coil, Chest or Unit

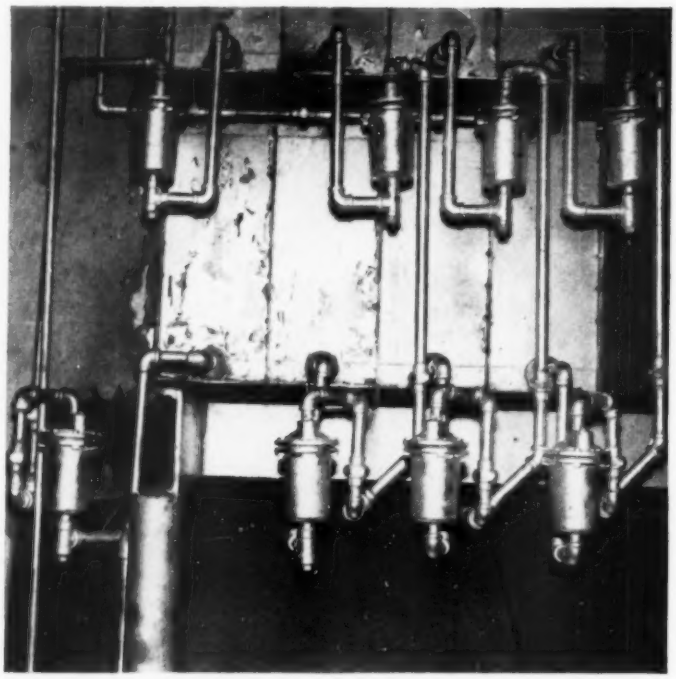
EXAMPLE

Dryer Temperatures at Guelph Creamery, Guelph, Ontario.

WITH GROUP TRAPPING (5 steam traps for 10 coils)	**225°F**
WITH BLOW-THROUGH (no steam traps)	**250°F**
WITH ARMSTRONG UNIT TRAPPING (10 traps—one on each of 10 coils)	**309°F**


HARDENED CHROME STEEL valve
STAINLESS STEEL guide pins
STAINLESS STEEL valve lever
HARDENED CHROME STEEL valve seat
STAINLESS STEEL valve retainer

One of the big advantages of Armstrong traps is LOW MAINTENANCE. Mechanisms in low and medium pressure traps identical in design, workmanship and materials to those in 900°F, 900 psig traps.



●The example at the upper left is simply one of thousands that bear out the benefits of "Armstrong *Unit* Trapping".

When you analyze it, the reason is quite obvious. No two steam coils, chests, chambers or machines will condense steam at exactly the same rate under operating conditions. There is a greater pressure drop in the units that condense the fastest. Steam will backflow through a common drain line from a higher pressure unit to a lower pressure unit. This blocks off flow of air and retards condensate flow from the lower pressure unit. On the other hand, if you separate each unit with its own trap, that can't happen.

You will *always* get higher temperatures and lower production costs with unit trapping. Ask your Armstrong Representative about it, or write:

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ARMSTRONG STEAM TRAPS

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ENGINEERS' PREVIEW

TVA IS well along on the construction of its most unusual "dam." It doesn't reach the bottom of the river. Engineers at the Kingston Tenn. Steam Plant, where it is being built, call it a "skimmer wall" because it will skim off the hot water at the top of the stream during hot weather months and allow the deeper, colder water to pass through for use in condensing steam. (See POWER ENGINEERING, June, page 75.)

At Kingston the cooling water is taken from a tributary embayment of the Clinch River arm of the Watts Bar Lake. Water in this arm during the months from April through mid-October stratifies in generally horizontal layers of different temperatures. On the surface, the water may be as hot as 90 deg or more, but in the deep layers temperatures are around 70 deg during the summer months. This lower, cooler water is what is wanted for cooling purposes.

The cool water comes mostly from Norris Lake. In that lake, water stratifies during the summer months with temperatures near the bottom as low as 45 deg. Discharging through the turbines, water of this low temperature flows down the river for some 65 miles to the head of backwater in the Clinch River arm of Watts Bar Lake. Here a natural phenomenon takes place. The cold flowing water, which is heavier than the warmer pooled surface waters, "ducks under" the warmer layers and flows down stream as a density current along the bottom of the reservoir arm. It is this deep, cold stream that the Kingston plant will tap. The skimmer wall is needed to keep out the hot upper layers of water.

WANT A JOB in the development of guided missiles? The U. S. Naval Air Missile Test Center, Point Mugo, Port Hueneme, Calif., has just sent us a 12-page list of job vacancies at the Center. These jobs are for electrical and electronic engineers, aeronautical engineers, physicists, and general engineers. For full information about them, apply to E. A. Rieson, employment superintendent at the above address.

• • •

STUDENTS will help to award a new engineering scholarship created at Cornell University by Scott Paper Co., Chester, Pa. The $1,000 grant to the outstanding senior in the five-year undergraduate mechanical engineering course will be decided by a board composed of three engineering students and four faculty members. It is the first Cornell scholarship on which students have a formal vote.

Student places on the selection board will be held by the presidents of Tau Beta Pi and Pi Tau Sigma honorary engineering societies and the president of the student branch of ASME.

• • •

SECOND of two 200,000-kw generating units at The Ohio Power Co.'s new Muskingum River Plant, near Beverly, Ohio, was placed in commercial operation June 1. Muskingum's Unit 2 is the fourth such 200,000-kw machine to be added in the past 11 months to the generating capacity of the American Gas and Electric Co. System, of which Ohio Power is a part. It raises total System capacity to 3,831,000 kw, serving a seven-state territory from southern Michigan to the North Carolina border.

• • •

ALAN HOWARD, manager of engineering for General Electric Company's Medium Steam Turbine, Generator and Gear Department at Lynn, Mass., has been honored for his contributions to the design and develop-

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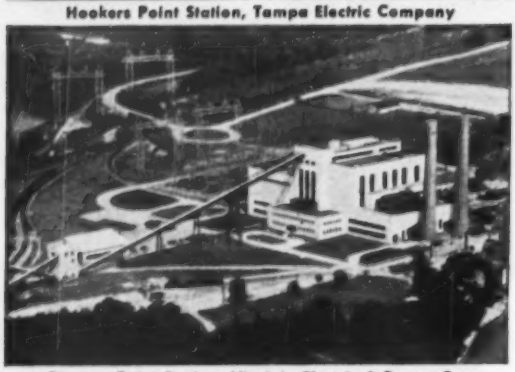
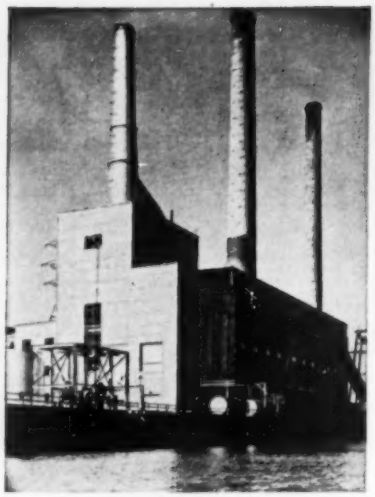
Hookers Point Station, Tampa Electric Company



Possum Point Station, Virginia Electric & Power Co.

Louisiana Station, Gulf States Utilities Company



Riverside Station,
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by
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and using

MODERN OIC VALVES

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Venice No. 2 Plant, Union Electric Power Company

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ment of turbines for aircraft, locomotives, power generation, and natural gas pipeline pumping. He has received an honorary degree of Doctor of Engineering from Purdue University. A member of many professional organizations, he currently is chairman of the Gas Turbine Power Division of ASME.

• • •

AIR CONDITIONING will become a billion-dollar-a-year business within the next decade, a General Electric Co. executive predicts.

Speaking at ground-breaking ceremonies for a new G-E hermetic motor plant at Holland, Mich., Ab Martin, general manager of the company's Hermetic Motor Department, explained that the new plant is necessary to provide hermetic motor parts for the rapidly-growing refrigeration and air conditioning industries.

"This new plant," he said, "is evidence of General Electric's faith in one of the fastest growing industries in our economy."

• • •

LIKE TO RELAX? Hire an analog computer to do your thinking. So advises *The Wall Street Journal* in reporting on the establishment by Electronic Associates, Inc., of a center at Princeton, N. J., equipped with computers and staffed by a dozen scientists. The center is designed to solve complicated engineering problems submitted to it by businessmen and industries. Fees range from $100 for a relatively simple problem, to $10,000 and up for a complicated one.

• • •

JAMES K. PICKARD, who resigned from the U. S. Atomic Energy Commission, has opened a consulting practice in atomic energy developments. He has set up his office in Washington, D. C., as successor to Frederick H. Warren, who recently became connected with the General Dynamics Corp.

So far as we are aware, Mr. Pickard is the first individual consultant in this field, outside of the various groups of utilities and large consulting firms now engaged in atomic energy work.

Mr. Pickard has worked in a number of atomic energy activities continuously since 1944 — with the Manhattan Engineer District, the AEC, and contractors of both government agencies. He was an industrial control engineer with the General Electric Co. before joining the atomic energy project.

Mr. Pickard's new field includes the impact of atomic energy developments on different types of business, and opportunities for business created by atomic energy, with emphasis on nuclear power and on its future uses.

Mr. Pickard leaves the Industrial Power Branch of AEC's Reactor Development Division, where he set up and administered the Commission's industrial participation program. By means of this program some three dozen firms have been enabled to study power reactor technology and appraise this and other atomic energy applications.

LETTERS TO THE EDITORS

Power Plant Grasp — Gile Comments

IN READING Power Plant Grasp, July 1954 issue, I must say it is a very good article.

The paragraph headed Memory and Thinking suits me best. I am a licensed engineer, have been since 1946. I was 24 years old at the time. I had only grammar school and school of hard knocks and have done a lot of home and plant study from different books. I agree with the author that old hard head ideas aren't worth much and that brings me to the paragraphs headed Which Direction and What's Pushed or Pulled.

Here, I disagree with the author. In regard to the direction to turn the engine to set the valve, the author says that "never once have we heard anyone say the engine should be turned in the opposite direction" to which it normally runs. I have never read in any of my engineering books this so-called ancient dogma. I have always seen it printed thus: always turn the engine in the *same direction* to make all of the marks on crosshead guides and flywheel rim. They do not say to turn the engine any specific direction.

There is a lot I don't know about engines, but I do understand them and can set the valves on them. I own an engine indicator and can use it. *L. E. Gile, Kansas City, Mo.*

The Static Charge-up Phenomenon

The article entitled Static Charges Might Cause Turbine Bearing Failures, published in the May 1954 issue of POWER ENGINEERING, impressed us very much because we recently experienced the failure of a turbine, having a capacity of 50 mw, which was put into service last March, and this may be the cause.

After two months of satisfactory service, the thrust bearing suddenly failed and many turbine blades were destroyed. After overhauling, very strong magnetization of the LP turbine casing was found, and very severe pitting and etching of bearing metals, supposedly caused by heavy electric current. Both indicated that the current, perhaps more than 1000 amp, might have flowed through the LP turbine shaft.

At first, the magnetization and the etching suggested a failure in the generator. But after careful inspection and testing, the generator proved to be quite satisfactory and neither failure nor damage was found.

Then we assumed that probably the thrust bearing had failed for some reason and that the large LP turbine shaft current might have been of secondary importance due to friction between blades and diaphragms. Consequently the oil was examined, and it was found to be good. There seemed to be no specific reason for such a sudden failure of the thrust bearing.

The turbine maker insisted that the shaft current was the sole cause of the failure, the thrust bearing being gradually pitted and etched by the shaft current. But the shaft voltage of the generator is only about 1.3 v, and the insulation of the bearing could not possibly have been so low as to allow the current to flow to the extent of damaging the bearing. So your report was very interesting and helpful to us. We decided immediately to examine the static charge-up phenomenon — *Masatoshi Yokosuka, Mitsubishi Electric Mfg. Co., Japan.*

Editor's Note: — Of course we will follow up with Mr. Yokosuka to see if his suspicions are confirmed and, if so, how he cures the trouble.

HERE'S WHAT THEY TELL US

"Training for Ingenuity," a stimulating paper by **Zuce Kogan** of Chicago, was presented to **Editor Andrew Kramer** for his comment. Mr. Kogan asserts that people can be taught or trained to think creatively and has established the Creative Thinking Institute for that purpose. In his reply, Mr. Kramer gives high praise to Mr. Kogan's efforts to establish the premise, saying:

> It is quite probable that a consciousness of what you call *approaches* can be of great help in organizing what otherwise would be haphazard thinking . . . Of course, there is always serendipity — the art of profiting from unexpected occurrences. This, however, need not lead us to the erroneous conclusion that it is useless to try to organize our approaches to problems.
>
> Your paper shows clearly that a knowledge of these approaches can be of inestimable value. You label these approaches, and show us how we can use them consistently.

. . .

J. William Young of the U. S. Atomic Energy Commission, in his request that we place the name of **Dr. James Phinney Baxter III** on our mailing list to receive *Atomics*, told us:

> Dr. Baxter as you may know (*he is president of Williams College*) was behind much of the work on the valuable history of the Office of Scientific Research and Development (OSRD) of World War II. He is now digging into reactor development for the AEC. I am sure that he will find the *Atomics* news letter extremely helpful.

The latest issue of *Atomics* sent to Dr. Baxter covers the liquid metal fuel reactor developed at Brookhaven Laboratory. Editor Kramer recently attended the International Conference on Nuclear Engineering at University of Michigan and informed us the system was announced at that meeting. Mr. Kramer believes it offers great possibilities and for the first time makes possible a high-temperature, high-pressure steam cycle similar to the ones now being used with coal, oil and gas fuels.

. . .

A feeling of warmth came into our hearts when a young engineer wrote:

> I have just finished reading your article, Power Plant Grasp (July '54, p. 84), and found it most interesting. As a young engineer with six years' experience in pumping stations and in city power plants, I have learned a lot. But as your article says, I sometimes get confused when someone asks me to explain certain things. I should really appreciate it if you would let me know how to get a copy of Mr. Browning's book Steam Plant Errors.
>
> I read your magazine each month and can't wait until the chief comes out with each month's copy.

. . .

Dwight V. Shumaker of A. J. Lindemann & Hoverson Co., also told us:

> After reading the first article by Frank H. Browning entitled Power Plant Grasp which I enjoyed very much, I should appreciate information on how to secure a copy of the book, Steam Plant Errors.

It was gratifying to know that Mr. Shumaker was much impressed with this article because we plan to publish two subsequent articles along the same line by Mr. Browning. We have also been much gratified with the dozens of requests from readers for information on how to get Steam Plant Errors as suggested in Mr. Browning's first article. If you want a copy, write Here's What They Tell Us, POWER ENGINEERING.

. . .

We were very pleased when **W. J. Harlow,** The New York, New Haven and Hartford Railroad Co. requested permission to reproduce the article Misguided Missile. We should like to see more publicity given to the importance of handling gas cylinders carefully. If you haven't read this short article, check your May issue, page 92.

"They're about to decide now."

Jay W. Courage, Western Electric Company, Inc., New York City, asked permission to reprint Modernization of Hawthorne Power Plant (May '53), written by Morrow and Born. Numerous requests are also coming in to reprint this year's article on the Hawthorne plant (July '54, page 86), entitled Demineralization Cuts Power Costs, by Morrow and Gehle.

. . .

Jack M. Doyle, from 'way down in Kentucky, wrote **Executive Editor Chester Earle** to tell him how much he liked the Stitzel-Weller article (July issue), and also added that he was quite intrigued with the editor's name of *Earle*. He said his mother's name was Earle and because it was rather unusual spelled with an "e", he asked our Mr. Earle if he had any literature on the Earle family.

There is a book at the Newberry Library in Chicago called "The Earles of Secaucus, New Jersey" from whom many of the Earles have descended, but the book can't be taken from the library. If any of our readers know of some available literature concerning the Earles, please contact our Mr. Earle, who is very anxious to assist Mr. Doyle.

. . .

Soon after publication of the article on thulium as an x-ray source (June issue, page 83), we received a telephone call from an electrical engineer in Pennsylvania. He was interested in the possible use of thulium x-ray, in place of the Beta ray, to be used for thickness gaging of steel strip.

After checking, we learned that the thulium x-ray could not be used for a Beta ray application. We were also told that thulium was in such limited supply that even the Rare Earths Division of the Atomic Energy Commission was unable to locate a sufficiently large quantity of it to make feasible its use industrially as a source of x-rays.

This information conflicted with an article in the May issue of *Nucleonics* reporting that within the last year, thulium has become available in metallic form at reasonable cost, and that the material's testing reactor provides an excellent facility for preparation of high specific activity sources.

L. C. Furney, Argonne National Laboratory, took the middle course. He told us:

> . . . I am sure that there will not be huge quantities of thulium available because it is one of the rare earth elements. However, I do believe that an increasingly large amount of this material will become available as fast as it can be produced and as the potential users demand it. I think that radioactive thulium sources will gradually be used where conventional x-ray equipment cannot be used. The number of these that will become available is anybody's guess.

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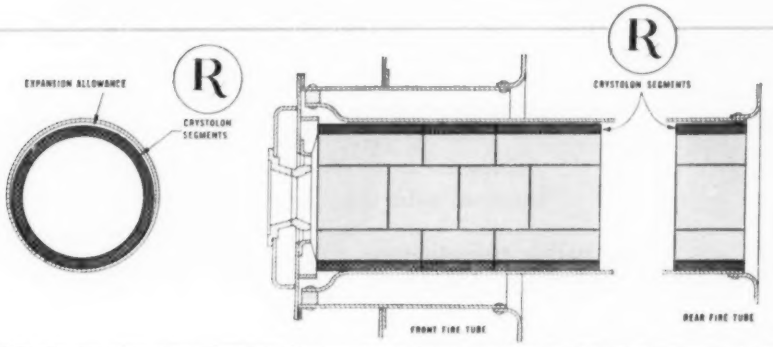
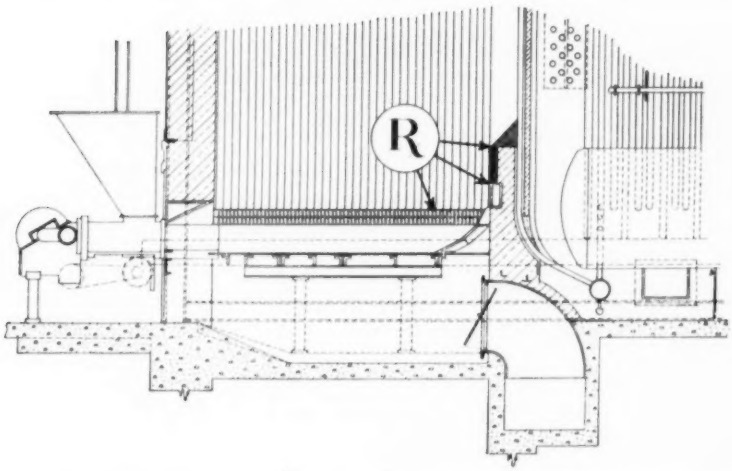


Fire Tube Packaged Boilers

CRYSTOLON segmental linings support combustion in the fire tube and protect the metal jacket. Use tongue-and-grooved segments for smaller sized boilers, arch brick for larger boilers.



Water Wall Packaged Boilers

CRYSTOLON armor block at the grate level overcomes the severe abrasive action of fuels and clinker formations. Brick and air setting cement of this same highly refractory material give added protection to the bridge wall.

Norton CRYSTOLON refractories, *engineered and prescribed* for better boiler performance, are characterized by exceptional hot strength, high refractoriness and thermal conductivity and great resistance to slag penetration, spalling and abrasion. Providing maximum protection against the mechanical and chemical attacks of a wide variety of fuels, they eliminate many costly repairs to grates and settings, as well as reducing downtime and maintenance costs to new lows.

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LOOK WHAT'S HAPPENING TO BOILER WATER GAGES.

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Better Illumination—improved mercury vapor illumination makes meniscus "shine like a star".

Body Improvements—flanged connections and expansion bends eliminate stuffing boxes and *prevent distortion*—separated design in four-glass inserts permit freedom for expansion—stainless steel facing for gasket recess provides corrosion proof surface for the higher pressures—close machining tolerances insure top quality.

Improved Gaskets and Mica—"Frelon" gaskets are coated with a special compound to prevent sticking at disassembly—wire inserts for the higher pressures give "Frelon" gaskets greater strength—thicker mica for the higher pressure gages.

"Floating Assembly" Covers—improved capscrews have wider shoulders at face of body—improved spring cones reduce spring cone stresses.

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YARWAY Gages are the "gages to see" on all new boiler units or replacements in high-pressure installations.

Write now for new YARWAY Bulletin WG-1812.

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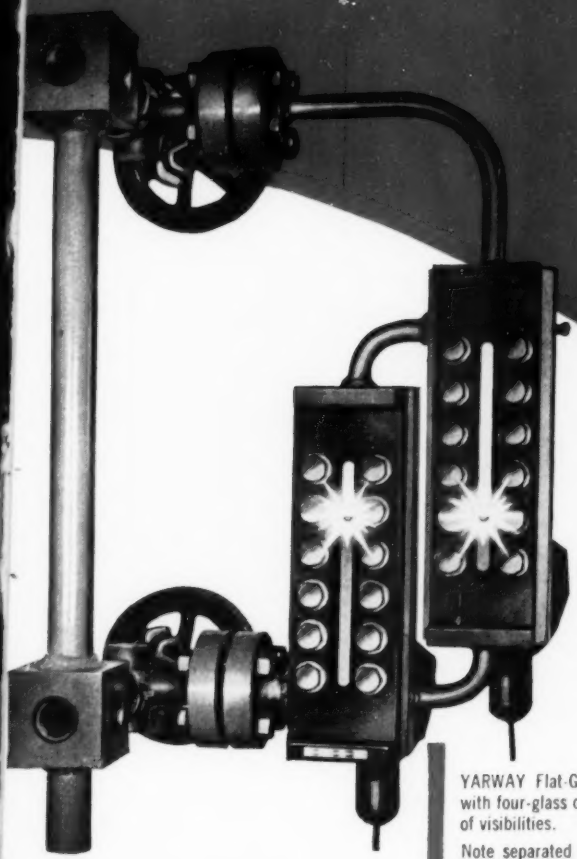
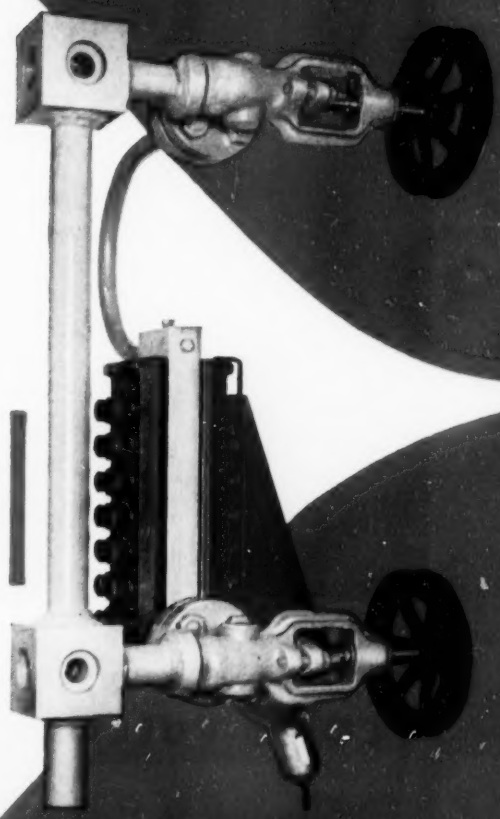
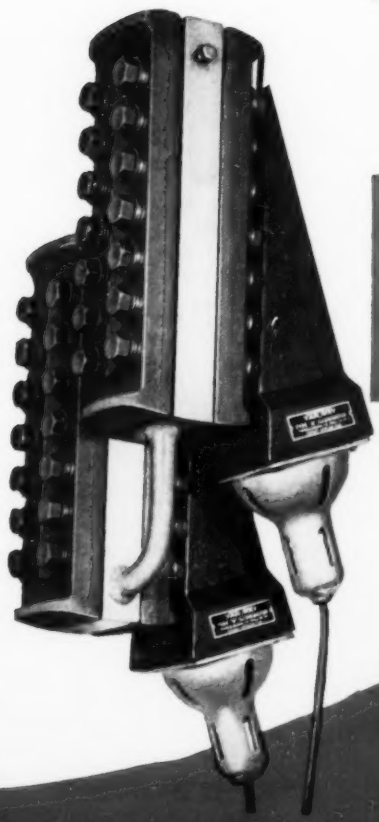


YARWAY Flat-Glass Water Gage Assembly with four-glass double insert for long ranges of visibilities.

Note separated design, interconnecting expansion loops, flanged connections (1½" tie-bar-type circulating water column) and Type "M" Illuminators that make meniscus at water level "shine like a star".



YARWAY Single Insert type gage for medium range of visibilities. Note expansion loop and flanged connections. YARWAY Welbond Gage Valves assure highest dependability in high-pressure service.

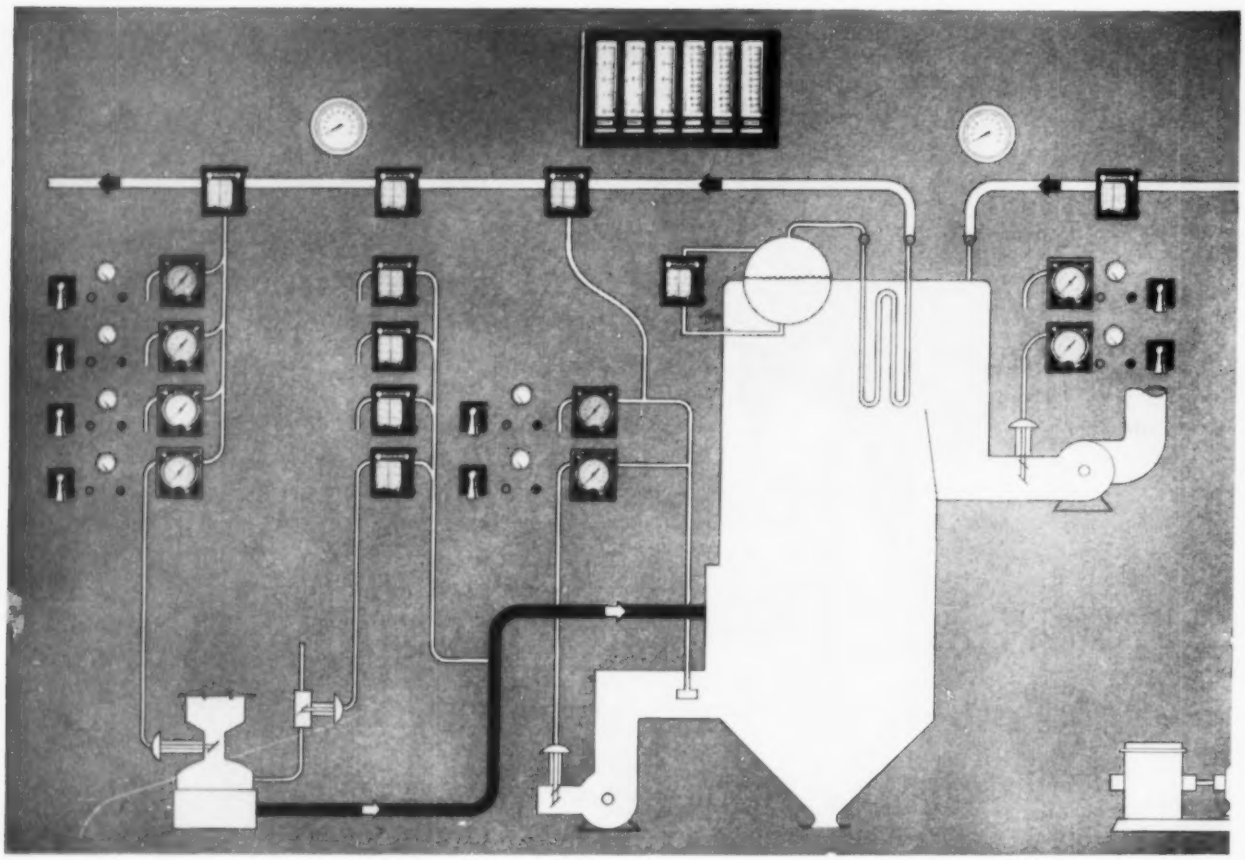


Close-up of YARWAY Type "M" Illuminators on above 4-glass insert assembly. The blue-white illumination is visible for distances up to 125 ft. and is especially effective in penetrating deposits on gage glasses, dust particles in the air and extraneous light.

YARWAY

water columns and gages

TO REDUCE



COPES-VULCAN OFFERS ALL THESE CONTROLS

COMBUSTION

Combustion may be controlled from steam flow-air flow, or by fuel-air-ratio method. Instrumentation of the most modern design by Taylor assures fast response, accurate control and utmost dependability.

FEED WATER

Boiler Feed Water may be controlled from three, two or one influences. Feed water control systems may have *instrumentation by Taylor* (Type 3-L, Bulletin 1013), or be electrically or mechanically operated.

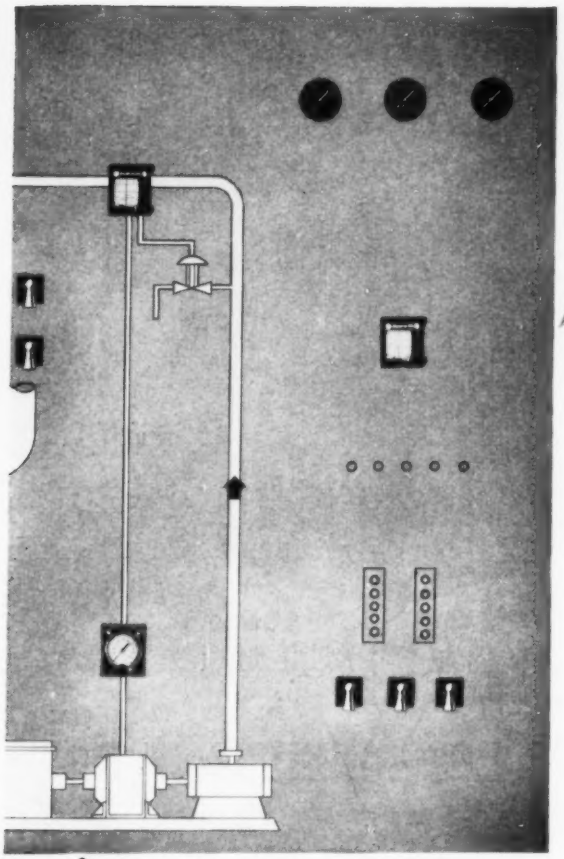
PRESSURE AND TEMPERATURE CONTROL

Pressure reducing valves to meet any need. Steam temperature control may be from three or two influences, using burner or damper positioning, gas recirculation, direct water spray or heat exchanger.

SOOT BLOWING

Full automatic-sequential control may be part of main panel or set up on separate panel. Individual push button control available. For smaller boilers there are manually operated units in several types.

STEAM COSTS



*Modernize With *C·V+T Boiler Control

WHEN you plan to modernize your power facilities, check into the many advantages offered by Copes-Vulcan Boiler Control.

From one dependable source, you can get modern combustion control *with instrumentation by Taylor*, precise feed water control, accurate steam temperature control and automatic cleaning of heat-transfer surfaces.

Remember, too, Copes-Vulcan assumes full responsibility for service wherever needed—for the life of your installation.

Ask Copes-Vulcan engineers for recommendations on how to reduce your steam costs. Write for Bulletin 1007-A.

*C·V+T=BBC

COPES · VULCAN + *Taylor* = BETTER BOILER CONTROL

COPES-VULCAN DIVISION

CONTINENTAL FOUNDRY & MACHINE COMPANY

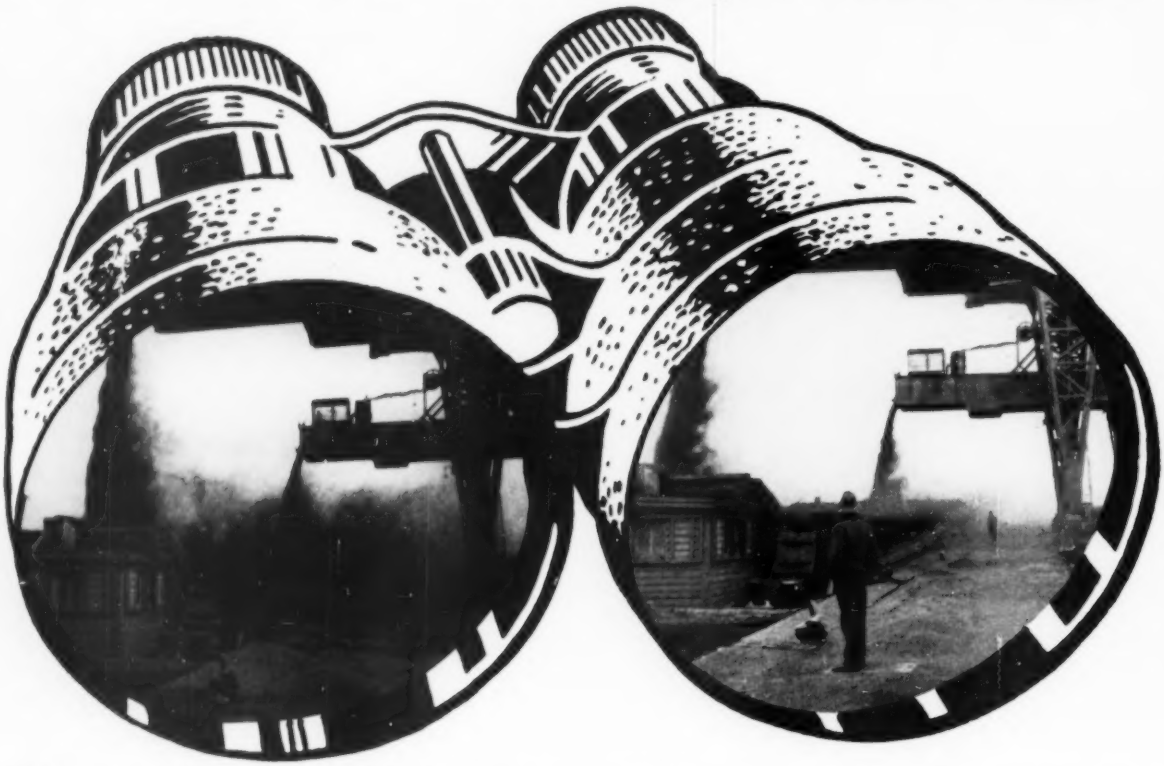
ERIE 4, PENNSYLVANIA

COPES VULCAN **BOILER CONTROL**

WITH INSTRUMENTATION BY *Taylor*

For more data circle 506 on Post Card

Look how this dock Stops Coal Dust



BEFORE—Barge loading of carbon size coal (¼" minus) at Eastern Railroad Coal Dock operating without the application of Johnson-March Compound "M". Note volume of dust.

AFTER—View of the same loading operation with a Johnson-March engineered system in operation. Note effective suppression of dust.

Here's how YOU can STOP COAL DUST!

A LOW COST Johnson-March engineered dust control system in operation in your plant enables you to eliminate the community dust nuisance and the threat of fires and dust explosions.

CONTROLLING COAL DUST in your power plant will "pay off" in reduced maintenance costs, and safer working conditions.

MANY LEADING POWER PLANTS now stop coal dust right at its source at car dumpers, hoppers, belt galleries, crushers and storage piles, with a Johnson-March System.

JOHNSON-MARCH ENGINEERED SYSTEMS cost only 1/10 that of mechanical systems, and maintenance cost is next to nothing. No bulky ducts, hoods or fans to interfere with normal operations.

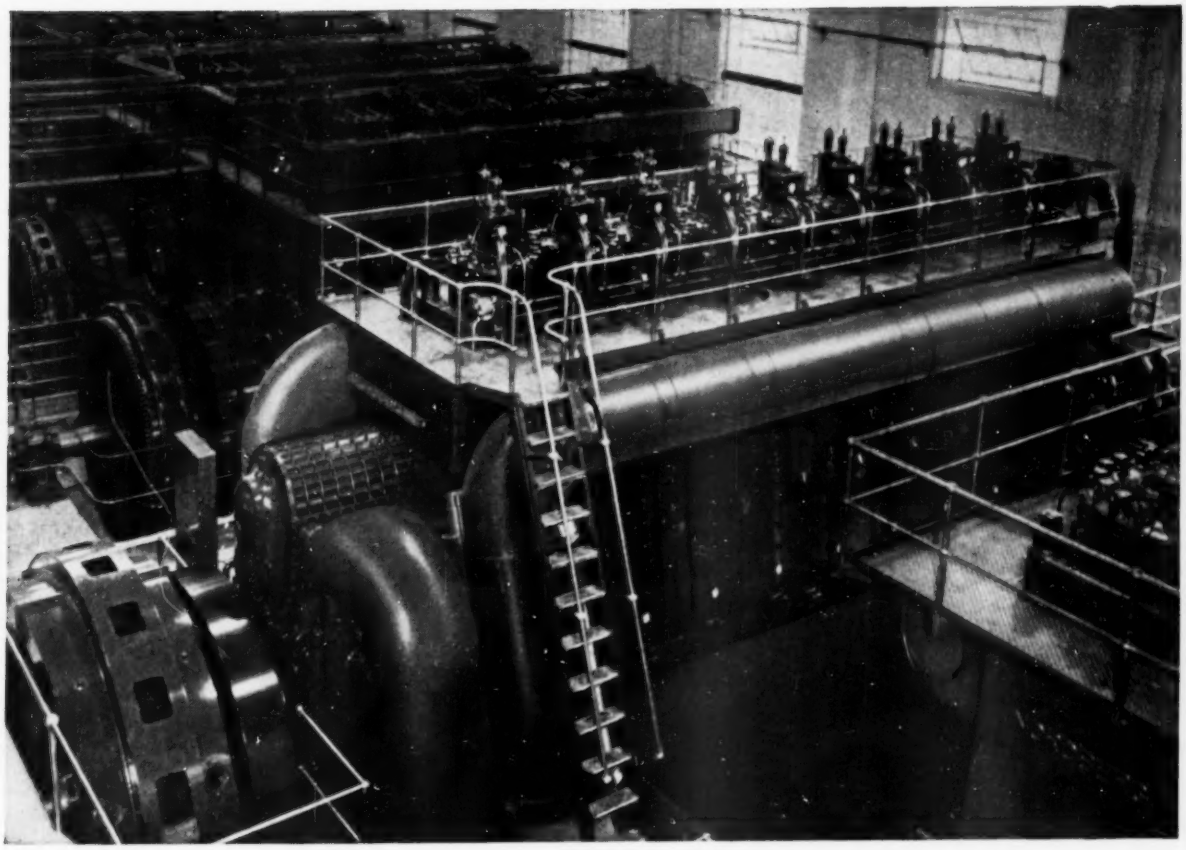
IF YOU now have no control over coal dust . . . or if you want to improve the effectiveness of an existing mechanical dust collection system, talk over your requirements with Johnson-March engineers. Drop us a line today.

Johnson March

Dust Control Engineering

DEPT. PE-2, 1724 CHESTNUT STREET, PHILADELPHIA 3, PA.

For more data circle 507 on Post Card



Largest Diesel Power Generating Station in the U.S.

reduces cylinder and piston ring wear with SHELL ROTELLA OIL

Electric power for the City of Grand Haven, Michigan, and the surrounding area, is generated by diesel engines in the largest municipal power station of its kind in the U. S. A. Shell Rotella Oil is the cylinder lubricant.

The anti-corrosive action in Shell Rotella Oil combats the major cause of engine wear . . . cylinder and piston ring wear caused by acid action from the by-products of incomplete combustion and condensation.

Tougher lubricating film in Shell Rotella Oil gives cylinders and rings greater protection . . . minimizes wear. Its effective detergent-dispersant action prevents harmful deposits.

Write for technical information. See for yourself how Shell Rotella Oil can help reduce your engine maintenance costs.

SHELL OIL COMPANY
50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

For more data circle 508 on Post Card

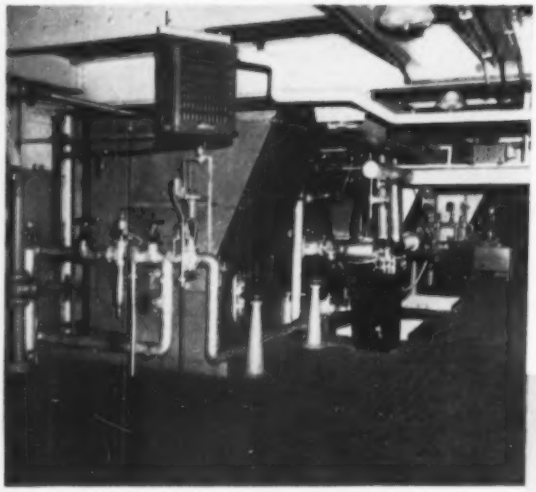
STEAM *helps make* STEEL

The United States Steel Corporation has purchased twenty-one steam generating units from Riley in the past fourteen years. Among these are the three steam generating units installed at Fairless Works.

These three 300,000 lbs./hr. units were designed for blast furnace gas fuel primarily, but can also develop full capacity on coke oven gas or liquid fuel.

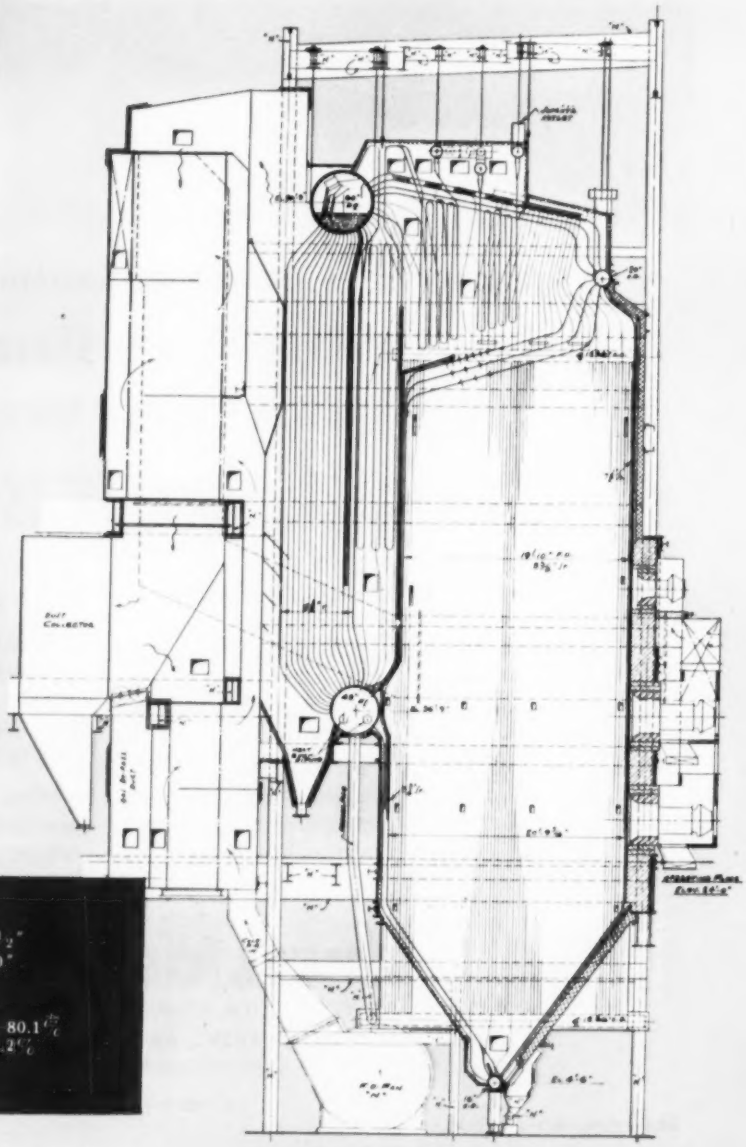
The desired steam temperature control range when firing blast furnace gas is obtained by the medium of a submerged heat exchanger in the lower boiler drum. Each unit is designed for future conversion to pulverized coal with Riley's exclusive single header hopper bottom furnace.

Other Riley units are operating at U. S. Steel plants in Braddock, Clairton, and Rankin, Pa., at South Chicago, Ill., and Gary, Ind. Three units are presently being installed at Johnstown, Pa.



Firing Aisle—showing controls for two of the three 300,000 lbs./hr. boilers at Fairless Works.

Riley Single Header Hopper Bottom construction reduces over-all height of unit and eliminates cost of separate hoppers.

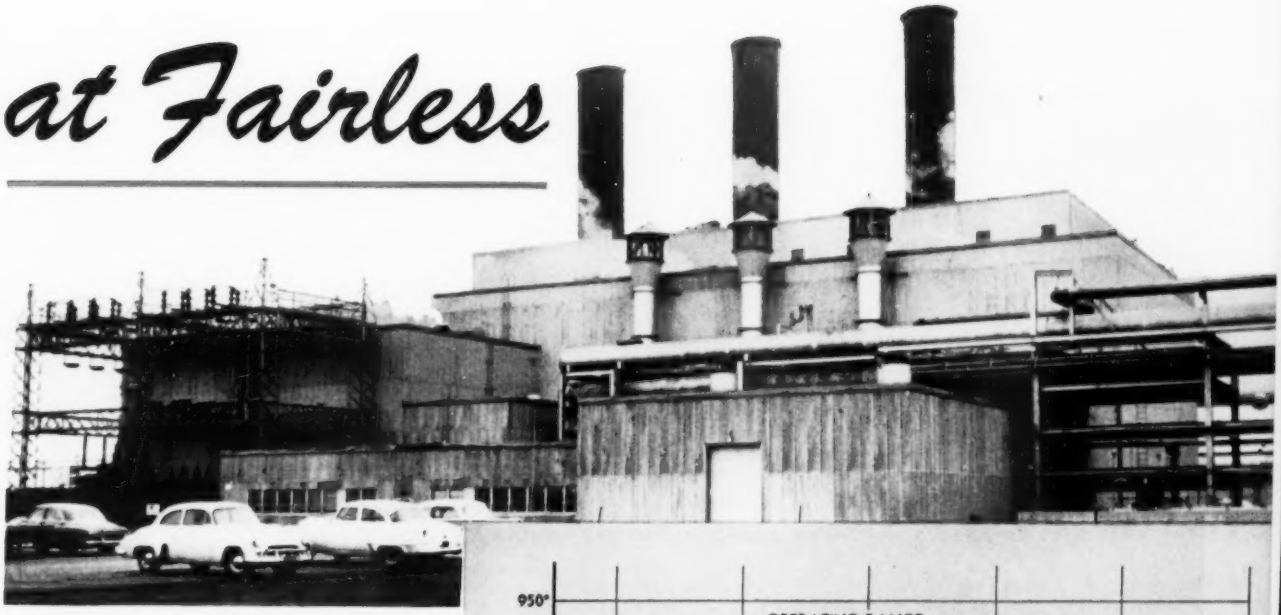


ENGINEERING DATA

Capacity—300,000 lbs./hr.
Design Pressure—885 psig.
Steam Temperature—900° F.
Heat Release per cu. ft. of furnace volume—18,300
Furnace Volume—26,570 cu. ft.
Furnace Width—25'7½"
Furnace Depth—19'10"
Furnace Height—57'
Efficiency
Blast Furnace Gas—80.1%
Coke Oven Gas—82.2%
Oil—86.4%

GIBBS & HILL—*Consulting Engineers*

at Fairless

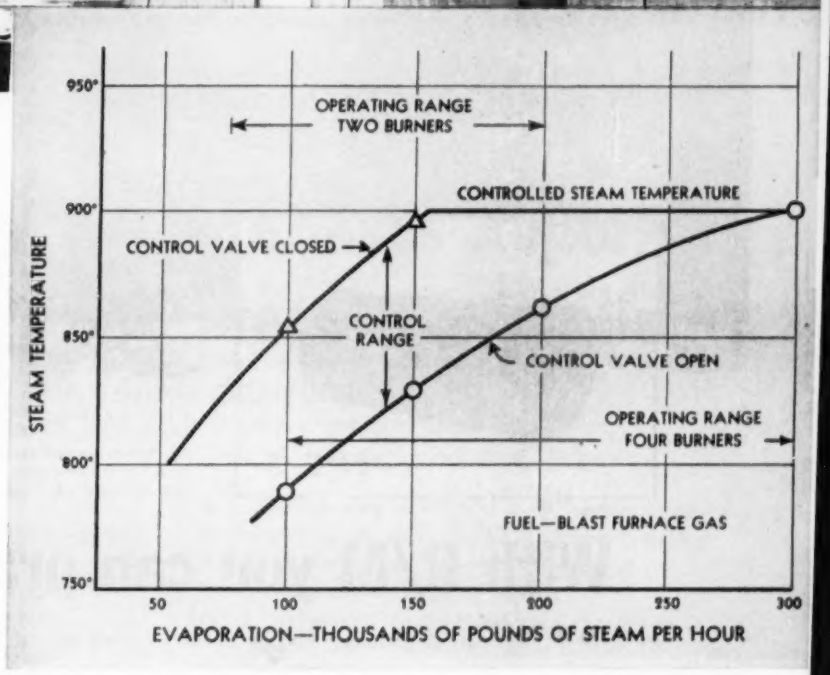


Boilers feature Constant Steam Temperatures Down to Half Load . . .

2 to 1 Control Range

Graph shows the wide range of temperature control obtained on each of the three Riley units when firing with blast furnace gas burners.

GIBBS & HILL—*Consulting Engineers*



A few other users of Riley units featuring Riley Single Header Hopper Bottom Furnaces

Whippany Paper Board Co.
Carbide & Carbon Chemicals Corp.
Colorado Fuel & Iron Corp.
Celanese Corp. of America
Monsanto Chemical Co.
Continental Can Co.
Hooker Electrochemical Co.
U. S. Rubber Co.
Western Electric Co.
Esso Standard Oil Co.
Swift & Company
Bird & Son, Inc.
Allis Chalmers Mfg. Co.
North American Aviation, Inc.
Calumet & Hecla Consolidated
American Viscose Corp.
Syracuse University
Great Lakes Steel Corp.

RILEY *Stoker Corporation*

WORCESTER, MASSACHUSETTS

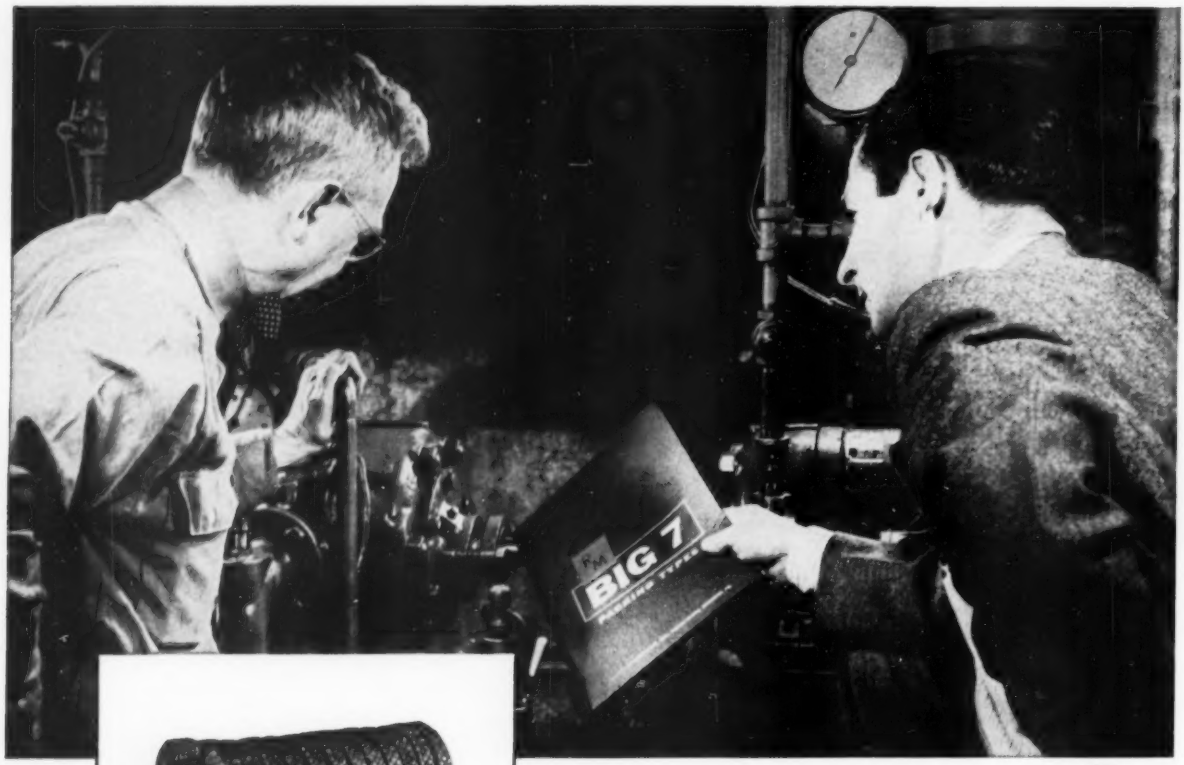
Boston New York Philadelphia Buffalo Washington Pittsburgh Cleveland Detroit Chicago Cincinnati Charlotte New Orleans
Atlanta St. Louis Kansas City St. Paul Tulsa Houston Denver Salt Lake City Los Angeles San Francisco Portland Seattle

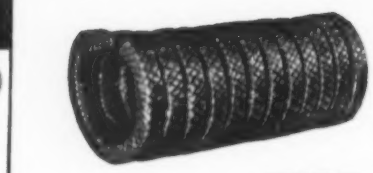
COMPLETE STEAM GENERATING UNITS

AND FUEL BURNING EQUIPMENT FOR PUBLIC UTILITIES, INDUSTRIAL POWER AND HEATING PLANTS

For more data circle 509 on Post Card

R/M's BIG 7 Packing Types meet 95% of all packing needs





TYPE 3

High speed rotary compressors like this one which supplies pneumatic tools with 230 cubic feet of actual free air per minute—compressing it from atmosphere to 100 lbs. gage—give top performance with R/M Packing No. 920, a packing included in Type 3 of R/M's Big 7 Packing Types.

With R/M you can practice P/M

By R/M we mean R/M packings. And by P/M we mean preventive maintenance. Hundreds of plants have already put an end to costly corrective maintenance by standardizing on R/M's Big 7 Packing Types. You can too. For this basic line of just seven field-tested packings (you probably need only three or four) is engineered to give custom-built performance in all but the very rarest applications. You can count on them to lower your inventories, reduce your downtime, cut your maintenance costs, and simplify your ordering. For details, call in your R/M distributor.

R/M PACKINGS FOR MAINTENANCE PURPOSES ARE SOLD ONLY THROUGH AUTHORIZED R/M DISTRIBUTORS

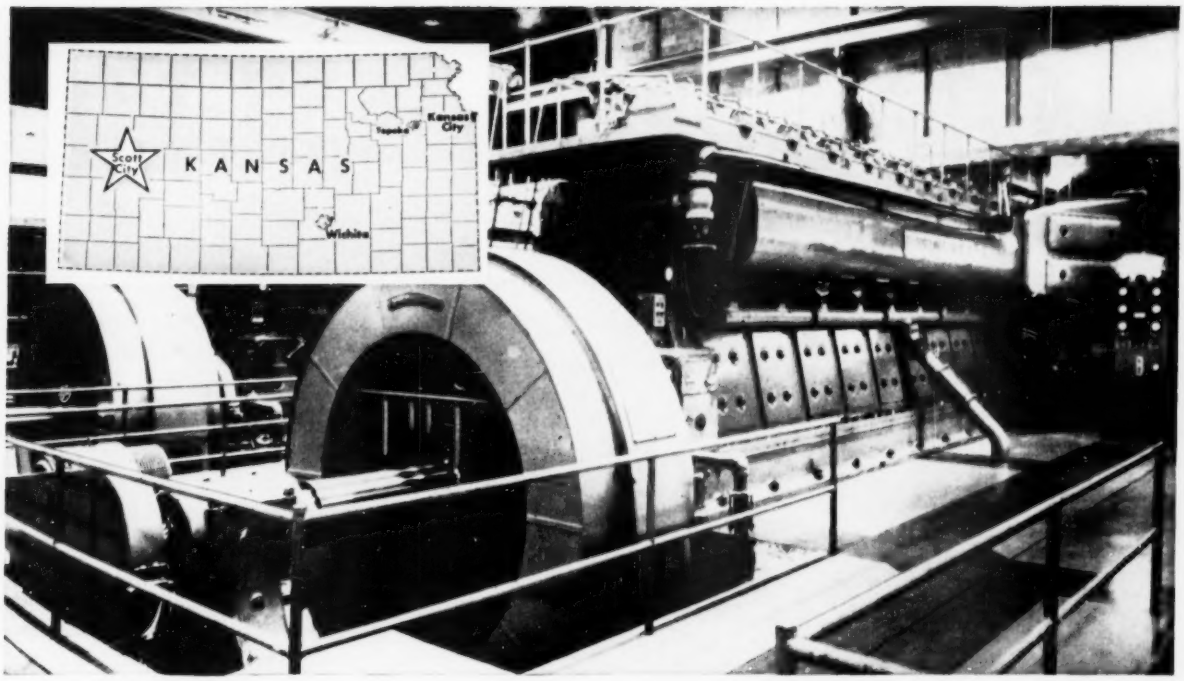
RAYBESTOS-MANHATTAN, INC., PACKING DIVISION, MANHEIM, PA.

BIG 7 PACKINGS

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada.

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

For more data circle 510 on Post Card

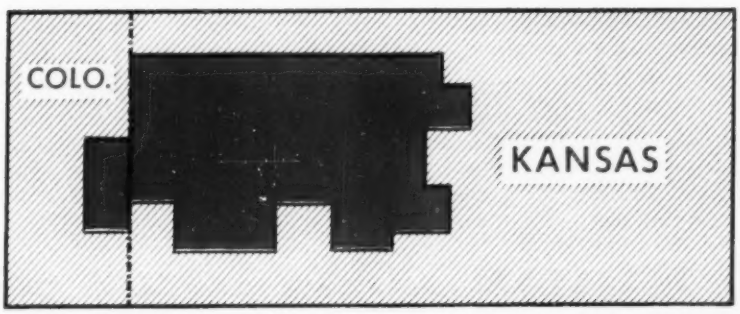


Largest REA Plant in Kansas Reports Cities Service DC-840 Diesel Oil Excellent!

Fairbanks-Morse Diesels of Wheatland Electric Cooperative, Inc. give outstanding performance using DC-840 Oil for power cylinder and crankcase lubrication. Here are the results Wheatland achieved:

1. House operation each unit—13,000 hours.
2. No oil changes due to oil failure.
3. No overhaul or major breakdown.
4. Rings free in groove with little or no signs of wear.
5. Oil consumption within mfgr's. recommendation.
6. Fuel consumption 10,572 BTU/KWH, load factor 63.7%.
7. Maintenance of lubricating oil at minimum expense.
8. 3500 H.P. hours per gallon of lubricating oil.
9. No wear on main or rod bearings.
10. No oil change at end of 9,000 hours.

For similar results in your Diesel operation, contact your nearest Cities Service office or write to Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



WHEATLAND ELECTRIC COOPERATIVE, INC. serves 3,300 square miles in all or part of Scott, Wichita, Hamilton, Greeley, Kearny, Wallace, Logan and Finney Counties in Kansas as well as sections of Kiowa and Prowers Counties in neighboring Colorado. Also supplies wholesale the Lane-Scott Cooperative serving 2,200 square miles in 6 Kansas Counties.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

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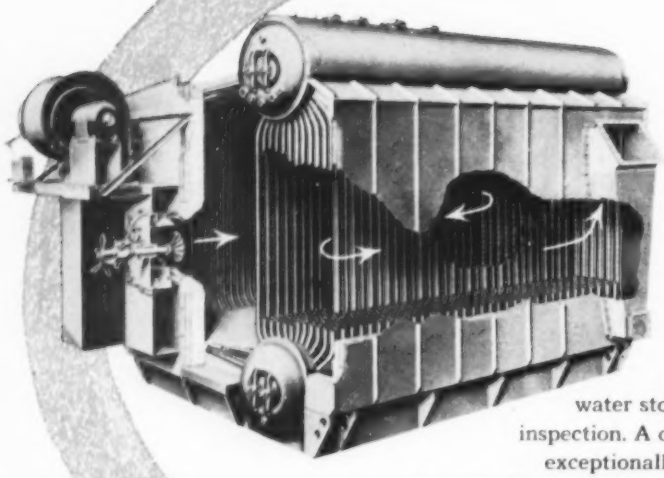
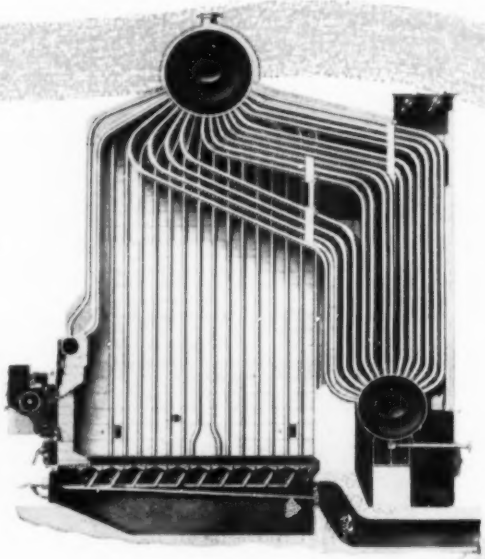
STANDARD BOILERS THAT



C-E Package Boiler, Type VP

This completely shop-assembled boiler is available in fourteen sizes from 4,000 to 40,000 pounds of steam per hour . . . for operating pressures up to 500 psi . . . for pressure firing of liquid or gaseous fuels. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large lower drum — 30-inch diameter — permits a simple, symmetrical tube arrangement . . . greater water storage capacity . . . easy access for washing down or inspection. A centrifugal fan, which operates at low speed and is exceptionally quiet in operation, is standard equipment. The simple baffle arrangement results in low draft loss . . . simple soot blowing . . . no dead pockets . . . high heat absorption. The VP is enclosed in a reinforced, gastight, welded steel casing, and shipped completely assembled with firing equipment, fittings and forced draft fan. For foundation, it needs only a simple concrete slab.



C-E Vertical-Unit Boiler, Type VU-10

The VU-10 is available in nine sizes from 10,000 to 60,000 pounds of steam per hour . . . for operating pressures up to 475 psi . . . superheat to 200 F in 20,000-60,000 lb range . . . for solid, liquid, or gaseous fuels. This boiler is a completely standardized design adaptable to many conditions. It is bottom-supported and needs no outside supporting steel. It operates efficiently over a wide range of output, and is easy to operate and to maintain. All parts are easily accessible for inspection. The VU-10 is a complete unit — boiler, furnace setting, fuel-burning equipment, controls, forced draft, heat recovery equipment (if desired). Regardless of fuel, the same general cross-sectional arrangement of drums, convection bank and furnace wall cooling is used. Uniform design through each transverse section assures even water level in the drum and uniform expansion.

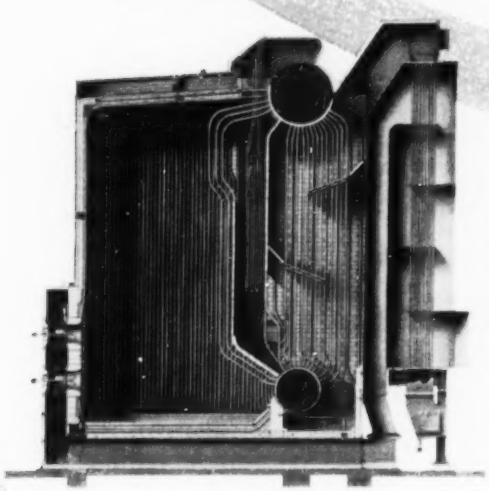
BOILERS, FUEL BURNING AND RELATED EQUIPMENT, PULVERIZERS, AIR SEPARATORS AND

SET INDUSTRY STANDARDS

Whatever your needs for steam may be, in the complete C-E line of fuel burning and steam generating equipment, you will find a type and size just right for your plant.

In the moderate capacity range, for example – that is, from 4,000 to 120,000 pounds of steam per hour – the three *completely standardized* C-E Boilers shown here offer advantages of economy and over-all performance that make them standout values in their respective fields of application.

These C-E Boilers are manufactured for the highest standards of performance, under a wide range of fuel requirements and operating conditions. Yet, because they are so fully standardized, their cost is well within the reach of the industrial budget.



C-E Vertical-Unit Boiler, Type VU-55

The VU-55 Boiler is available in six sizes from 50,000 to 120,000 pounds of steam per hour . . . for operating pressures of 250 psi or 500 psi in each size . . . with superheat and heat recovery equipment if desired . . . for liquid or gaseous fuels. Like the VU-10, this boiler is of symmetrical design, each transverse section being identical with every other section. Thus the gas temperature entering the boiler bank is constant across the full width of the unit. No outside supporting steel is needed, since the boiler is bottom-supported. The basic design for the VU-55 was originated by Combustion in 1925 and has achieved wide acceptance among steam-power engineers everywhere. Its narrow, high furnace . . . integral design of boiler and preheater . . . absence of exterior ductwork . . . and the compactness resulting from modern, coordinated design – all help the VU-55 reach a standard of economic performance closely approaching that obtained in large central power stations.

Other C-E Industrial Boilers

In addition to the standard boilers shown here, the Combustion line includes many other 2-drum designs available for capacities up to 350,000 pounds of steam per hour, which can be designed to burn any commercially available fuel. These units are available for use with pressures up to 1375 psi and steam temperatures as high as 960 F. They may incorporate heat recovery equipment of any type, and can be arranged for difficult space conditions. So – whatever your steam needs – call Combustion for details on the complete line of C-E Industrial Boilers.

B-767

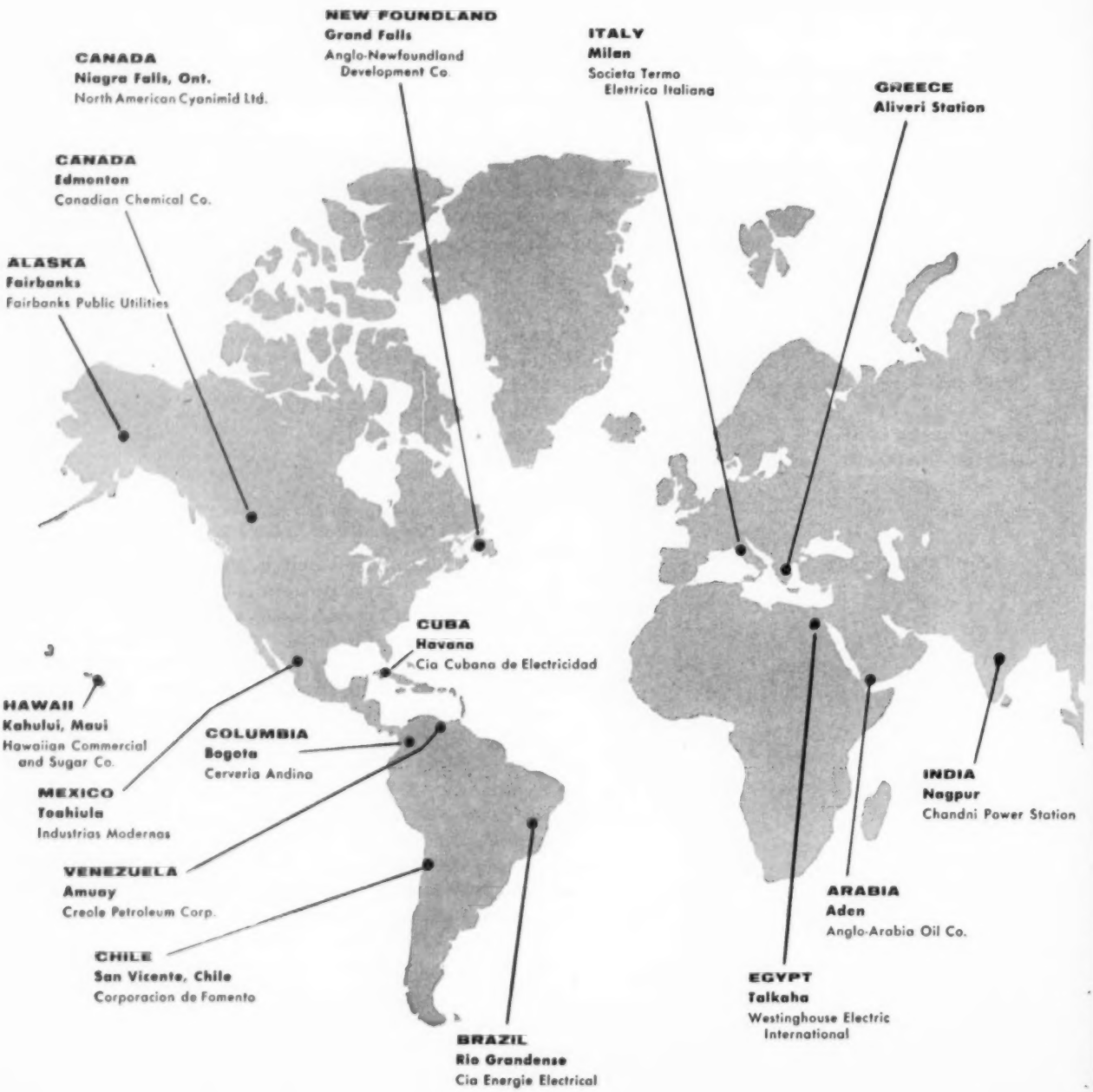
COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.

FLASH DRYING SYSTEMS · PRESSURE VESSELS · AUTOMATIC WATER HEATERS · SOIL PIPE

For more data circle 512 on Post Card

Choose the Combustion Controls

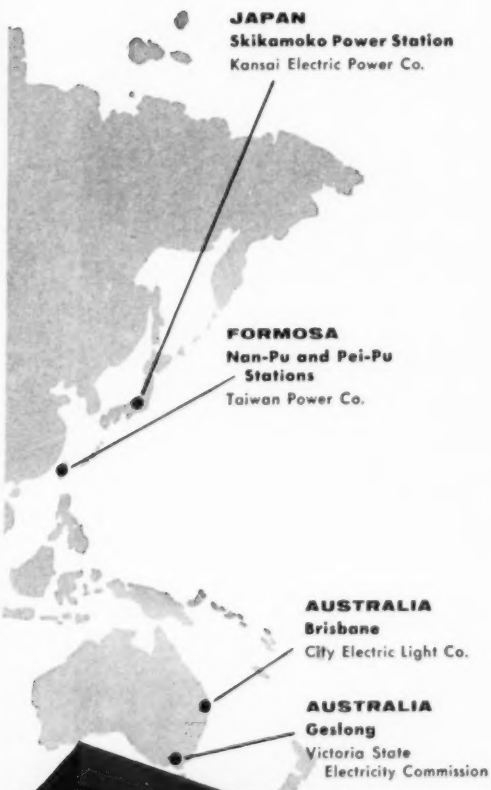


THIS IS ONLY A PARTIAL REPRESENTATION OF POWER PLANTS OUTSIDE OF THE UNITED STATES WHICH RELY ON REPUBLIC CONTROLS.

REPUBLIC FLOW METERS CO.

with a World-Wide Reputation

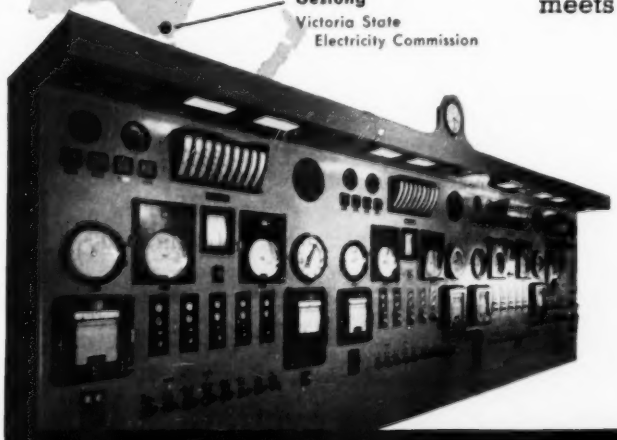
REPUBLIC *Automatic* COMBUSTION CONTROLS



Combustion efficiency is spelled and pronounced many different ways throughout the world. It's even expressed in two different units — pounds or kilograms of steam produced per unit of fuel consumed. No matter how you spell or measure it, however, its importance is the same to power plants everywhere — in ancient Peru or the distant Philippines.

To get maximum combustion efficiency in power plants all over the world, engineers have specified Republic Controls again and again. With Republic, they know they are getting an extra "plus" in dependability because Republic Controls are ruggedly built to match the high availability of other equipment in the plant.

In *your* plant, insure maximum combustion efficiency and dependability by specifying Republic. At your service is an engineering staff with more than 35 years of specialized experience in power plant control to help you design the system that best meets your needs.



REPUBLIC Automatic COMBUSTION CONTROLS

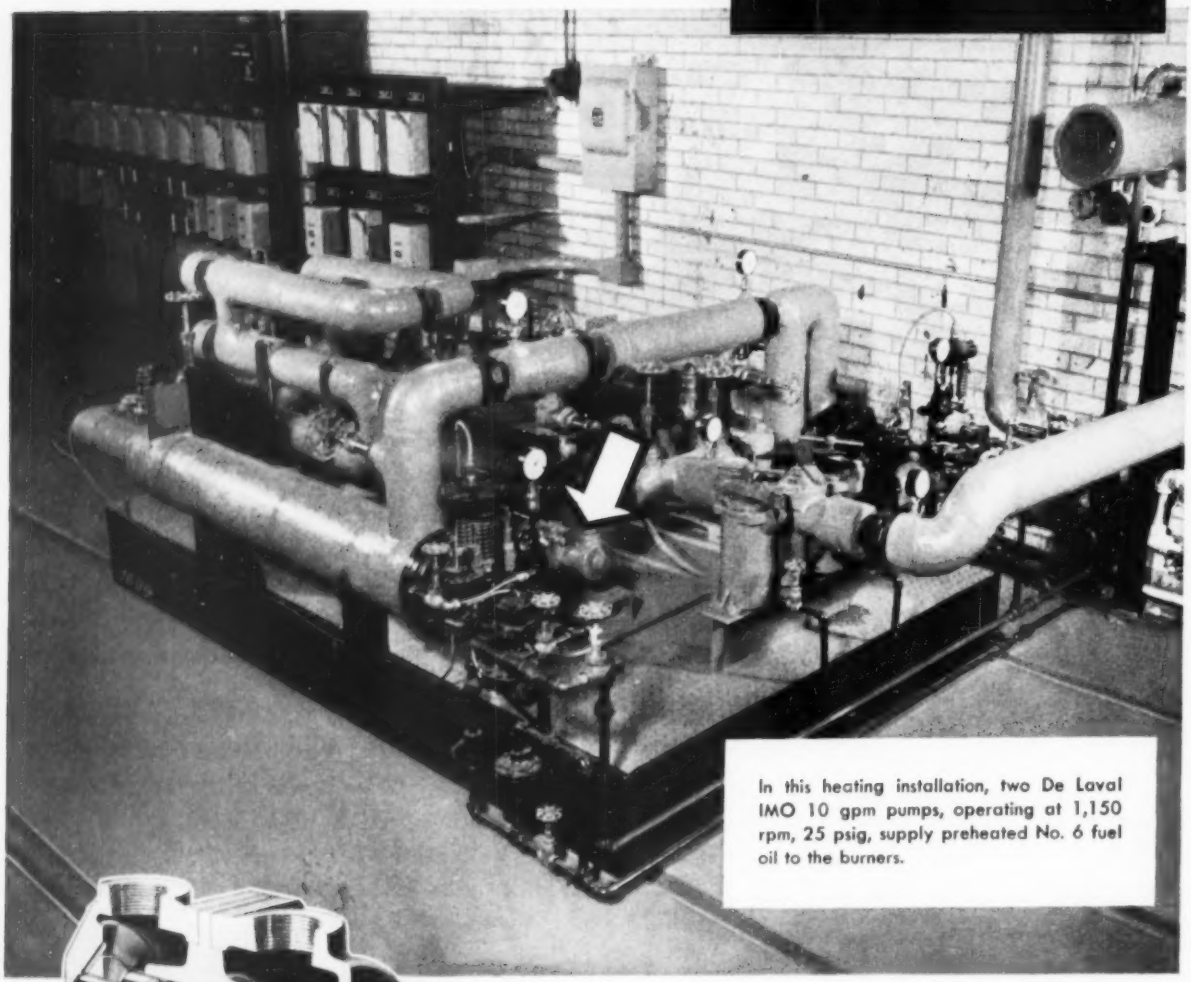
- For all types and sizes of boilers
- For all types of fuel
- For all types of firing
- For all arrangements of draft
- For all load conditions

2240 Diversey Parkway • Chicago 47, Illinois

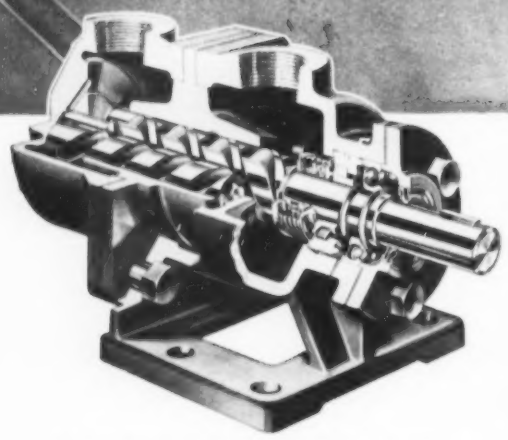
For more data circle 513 on Post Card

Contracts are more profitable when you install dependable

DE LAVAL
IMO PUMPS



In this heating installation, two De Laval IMO 10 gpm pumps, operating at 1,150 rpm, 25 psig, supply preheated No. 6 fuel oil to the burners.



A wide range of De Laval IMO models specifically built for fuel oil service is available. Capacities up to 80 gpm, pressures to 275 psig. Write today for Bulletin LG-A.

To increase your present—and future—profits on commercial heating jobs, install *dependable* De Laval IMO pumps on pump and heater sets. Their simple, trouble-free design saves you money on service calls. . . builds customer goodwill, for there's nothing to get out of order or need adjustment. No pilot gears, no sliding vanes, no reciprocating pistons. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
816 Nottingham Way, Trenton 2, New Jersey

DL272

For more data circle 514 on Post Card

"You see POWELL VALVES everywhere!"

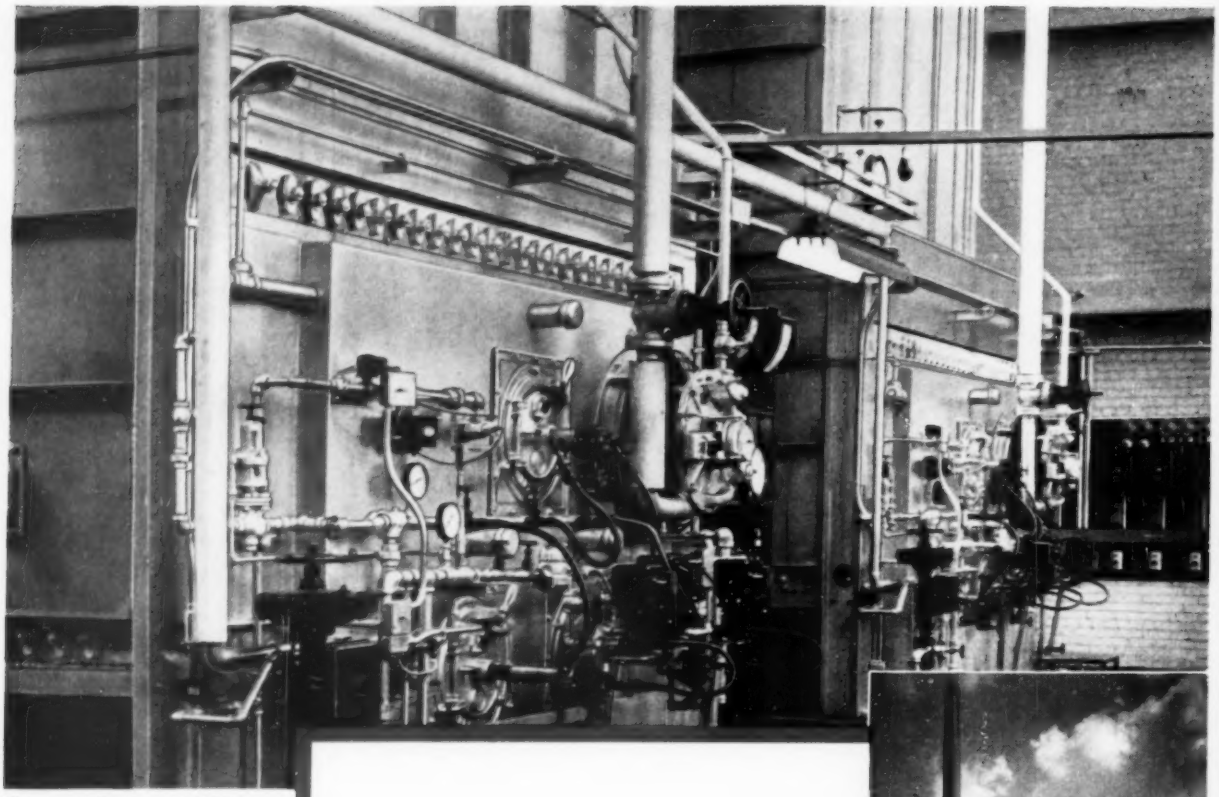
Not surprising when you realize that Powell makes more kinds of valves and has probably solved more valve problems than any other organization in the world. And this has been going on since 1846.

Wherever flow requires dependable control, there's the place for Powell Valves—available through distributors in principal cities. Made $\frac{1}{8}$" to 30" and 125 pounds to 2500 pounds W. S. P. Bronze, iron, steel and corrosion resistant alloys. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

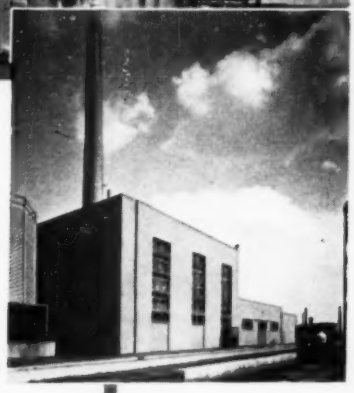
CONTROLS FOR THE LIFE LINES OF INDUSTRY

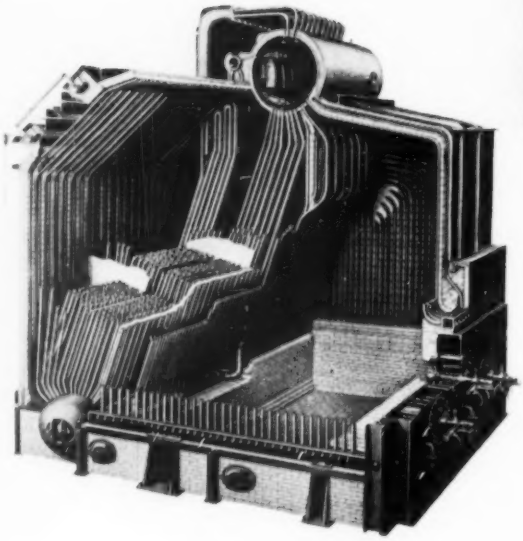
Powell Valves 108th year

For more data circle 515 on Post Card



This installation of B&W Integral-Furnace Boilers at the Chicago plant of Wesson Oil Co. is producing "cheap" steam through efficient operation and with minimum maintenance and labor.





Sectional view of typical oil-fired B&W Integral-Furnace Boiler similar to units in service at Wesson Oil plant. Suitable for oil, gas, and coal firing the Integral-Furnace Boiler family is available in steam capacities to 350,000 lb per hr. Cost saving features covered in bulletins available on request.

G-633

on the record . . .

2 B&W Integral-Furnace Boilers at Wesson Oil's New Chicago Plant provide

PERFORMANCE with ECONOMY

Despite unusually severe operating conditions, with frequent and wide load swings at odd times and without warning, two B&W Integral-Furnace Boilers at this plant are providing steam efficiently and economically, to the complete satisfaction of company engineers. And performance such as this is being duplicated in plant after plant across the country—both new and old—where operational savings over a relatively few years are proving sufficient to cancel the initial investments.

Southern Cotton Oil Company—processor of the popular Wesson Oil and hydrogenated shortening—needed a fully-reliable steam supply for its new Chicago plant, with "push-button" operation wherever practical. To meet these requirements, they chose long-life, automatically controlled B&W Integral-Furnace Boilers. Oil-fired at present, they can also burn gas and may be converted readily to coal firing if conditions warrant. Each unit has a steam capacity of 40,000 lb per hr at pressures to 250 psi. They supply steam for year 'round processing and carry the additional load for heating during winter months.

An efficient system of automatic controls makes operation of these B&W Integral-Furnace Boilers quite simple. This emphasis on automatic operation has "paid off" at the new plant, which is producing steam with minimum maintenance and operating labor. These advantages are, of course, reflected in the plant's low overall steam cost.

Layout of the boilers and plant was under the direct supervision of Mr. L. C. Haskell, vice president of Southern Cotton Oil, working with the company's consulting engineers, The Austin Company, who designed and constructed the building. B&W erected the boilers, then ran complete operational tests before turning them over to Southern Cotton Oil Company as satisfactory, operating units. We shall be glad to discuss details of any unit in the B&W "family" of Integral-Furnace Boilers in terms of your steam requirements. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd St., New York 17, N. Y.

Service-Proved

COST SAVING FEATURES

of B&W Integral-Furnace Boilers for Steam Requirements from 2900 to 350,000 Lb Per Hr.

- Minimum floor space and headroom requirements
- High fuel economy
- Smokeless combustion
- Adaptable to all fuels and firing methods
- Economical fast steaming
- Water-cooled furnace
- Clean, dry steam at all ratings, even with high boiler-water concentration
- Quick response to wide and heavy load swings
- Easy to inspect and clean
- High availability with least attention

BABCOCK & WILCOX

BOILER DIVISION

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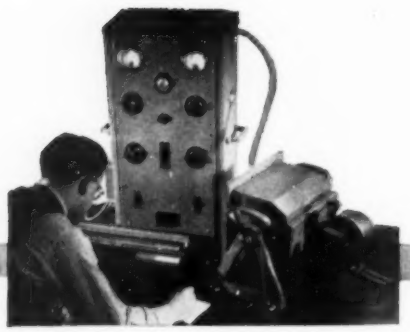
SMALL PLANTS, TOO!

CAN PROFITABLY USE THE *Nalco* SYSTEM



X-Ray equipment, used in the Nalco Laboratories as an aid toward providing positive water treatment results.

● *Water treatment service for small plants is an important part of Nalco's business.*

This indicates two things:

Small plants find Nalco Service Agreements a profitable investment . . . And

Nalco facilities and services are geared to handle — efficiently and economically — the needs of *any* plant, regardless of its size or the volume of water treatment chemicals used.

If your plant is a small one, you can get the same security from water treatment difficulties as many of the world's largest steam generating stations have with Nalco Service Agreements — and at a cost entirely in line with the size of *your* plant and your problems. Write today for complete details, or call your Nalco Representative.

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THE *Nalco*® SYSTEM...Serving Industry through Practical Applied Science

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HELPFUL BULLETINS

ELECTRICAL EQUIPMENT

101 Electrical Installations — This handsome 44-pp book illustrates and describes recent electrical installations. They include generating units, control room equipment, line transformers, substations, distribution equipment, arc furnaces, conduit runs, rectifiers, lighting equipment, strip mills, others. Includes list of principal clients of this company. Patterson-Emerson-Comstock, Inc.

102 Two-Pole Induction Motor — Bulletin 05R8123, 8 pp, describes design of company's two-pole motors 900 hp and larger, for boiler feed pumps, pipeline pumps, centrifugal blowers. Diagrams include sectioned view of a typical large squirrel-cage induction motor and one showing how the machine is spirally ventilated. Allis-Chalmers Mfg. Co.

103 Cable Trays — This 12-pp catalog describes cable trays which offer a simplified method of supporting power and control cables. Presents straight run essential units, also those for horizontal and vertical runs, and miscellaneous fittings. Illustrated with installation photos, sketches of these strong but lightweight supports, booklet includes load deflection data, tracing templates. Fab-Weld Corp.

104 Electrical Trouble Shooter — This 8-pp booklet describes the Brunt Faultfinder, an electrical maintenance instrument for locating grounds in normally undergrounded electrical circuits. Well illustrated, contains information on purpose and operation of several models available. Parr Mfg. Corp.

105 Ballast Sound Ratings — Bulletin GEA-5672B describes the five different sound ratings available in manufacturer's ballasts, and their use in fluorescent lighting applications. Discusses other factors affecting ballast application for minimum noise levels, including vibration of fixtures and acoustical characteristics of wall surfaces. General Electric Co.

MECHANICAL POWER TRANSMISSION

106 Heavy-Duty Chain Drives — Catalog C 72-51 is a revised 16-pp profusely illustrated catalog offering new and expanded data on company's Hy-Vo high speed, heavy-duty chain drives. Operating principles and test data are provided for drives that will carry up to 190 hp per inch of chain width at continuous chain speeds up to 6000 fpm. Specifications and capacity curves are included for standard chain, and installation and lubrication recommendations are given. Morse Chain Co.

107 Improved Motor Pulleys — The complete redesign of this company's standard line of Vari-Speed motor pulleys is described in 28-pp Bulletin V-545. Replete with illustrations, some in full color, this booklet covers construction details, lubrication, controls available. Provides instructions on how to select proper unit, complete rating tables and dimensional diagrams. Also includes data on the Vari-Speed Jr. Reeves Pulley Co.

108 Motorized Reducers — For users of gear drives up through 75 hp rating, Bulletin 3100, 28 pp, offers selection tables, dimensions, weights, overhung load ratings and thrust capacity ratings needed to select company's horizontal, vertical or right angle Motoreducers. Bulletin's fold-out section illustrates mounting positions, low speed shaft connections and product features. The Falk Corp.

109 Linear Ball Bearings — Form 100A is a 12-pp catalog on this manufacturer's Ball Bushings, offered as a solution to problem of sliding linear motion. Low friction, design economies, elimination of binding and chatter, and other advantages — 22 in all — are discussed. Shafting, sealing requirements and lubrication are treated, and installation procedure given. Also provided are drawings showing mounting arrangements, and load capacity tables. Thomson Industries, Inc.

110 Reusable Coupling — Bulletin 105 describes, gives dimensions on a two-piece reusable hydraulic hose coupling with Interlock grip for one-wire braid cotton cover hose. Shows how to make up hose assemblies, gives installation photos and instructions. Eastman Mfg. Co.

111 Quick Couplings — Eight-pp Bulletin 54-1 describes Pushomatic quick couplings for air, hydraulic, or fluid handling applications. Illustrated with photos and dimensional drawings, bulletin explains quick connection, no leakage, compactness, safety. Breco Mfg. Co., Inc.

PUMPS, PUMPING

112 High Pressure Pumps — This bulletin describes company's series of air-driven, high pressure, hydraulic pumps. Lists eight models with discharge pressures from 1100 to 33,500 psi, describes operation in high-pressure, low-volume service such as hydrostatic testing. Sprague Engineering & Sales Corp.

113 Cradle Mounted Pumps — Bulletin 247, covers company's cradle mounted Compacunits. Includes construction features, sectional and external views, dimensions and material specifications. Warren Steam Pump Co., Inc.

PACKINGS

114 Braided Packing — Illustrated 8-pp Bulletin A-131 describes manufacturer's Lattice Braid rod and shaft packings. Points out construction features, and discusses available materials, sizes and forms. Also contains service reports from users, and includes general service recommendations. The Garlock Packing Co.

115 Molded Packings — This 8-pp illustrated bulletin describes molded hydraulic and pneumatic packings, including company's Vee-Flex and Homogenous V-Packing rings, and piston cups. Gives features and service recommendations, lists standard sizes. Packing Div., Raybestos-Manhattan, Inc.

MAINTENANCE

116 Plant Cleaning Guide — How-to-do-it charts based on in-plant maintenance procedure are featured in Bulletin F. 9394, a 12-pp pocket-size folder. Lists recommended cleaning materials, application methods, concentrations and temperatures for cleaning, treating water in air conditioning, refrigeration units. Describes company's cleaning materials, steam guns, hot spray unit. Oakite Products, Inc.

117 Synthetic Resin Coatings — Eight synthetic resin coatings — Vinyl, Phenolic, Saran, Plastisol, Polyethylene, Epon, Neoprene and Silicone — are described briefly as to features and use in this 8-pp bulletin. Photos show application to storage tanks. Metalweld, Inc.

LUBRICANTS

118 Lubricant Recommendations — Featured in this 20-pp booklet are lubricant recommendation charts covering a wide range of lubricating applications and showing which of company's product is best suited for each. Also provided are data on metal working lubricants and cable pulling compounds. Includes product listing. Adam Cook's Sons, Inc.

119 Anti-Corrosion Lubricants — Specialized lubricants for application against corrosion and leakage loss, especially when vacuum pump cylinders, pump packing glands, plug-type valves are used, are described in Bulletin BK-20, 8 pp. Lists lubricants for many industries, under various operating conditions. Includes application table, selector chart showing how lubricants can be used against more than 160 corrosive agents and solvents. Keystone Lubricating Co.

The new and revised publications reviewed on these pages offer help on many operating and maintenance problems. To order them, use the Reader Service Cards on pages 113-114

120 Dispersions for Industry — This bulletin lists 40 dispersions of colloidal graphite, molybdenum disulfide, vermiculite and zinc oxide. Gives typical applications, densities, carriers, other data. Includes listing of dispersions offering advantages of new epoxy resins as bases for "dag" colloidal graphite and molybdenum dry-film coatings. Acheson Colloids Co.

INSTRUMENTS AND CONTROLS

121 Industrial Instruments — Catalog 5001, 28 pp, is a revised edition of company's composite catalog on instruments for indicating, recording and control

of variables. Describes and pictures pyrometers, potentiometers, thermometers, pressure gages, flow and liquid level meters, panelboards, diaphragm motors and motorized valve assemblies, switches and starters. Industrial Div., Minneapolis-Honeywell Regulator Co.

122 Flowmeters—Bulletin 1052, gives design features, maximum flow capacities, maintenance requirements and mounting drawings of a new compact, low cost multiple stage flowmeter, primarily designed for automotive, aircraft, chemical and petroleum industries. Includes full size sections of individually graduated 18 in. logarithmic scales, view of "inner wall" guides, and complete flow range chart. Commercial Research Laboratories, Inc.

123 Flow Indicator — Bulletin 190, 8 pp, describes company's Flow-Mizer, a low-cost, single or multi-tube flow indicator, designed for accurate measuring of non-corrosive liquids and gases at moderate pressures. Includes construction details, dimension drawings, capacity charts. Brooks Rotameter Co.

124 Pneumatic Controllers—Stack-type pneumatic controllers for process variables are illustrated with cut-away construction photos, schematic diagrams and dimension drawings in Catalog 53-10, 12 pp. Specifications, controller response actions, controller selection guide are also provided. Fischer & Porter Co.

125 Dall Flow Tubes — Sixteen-pp of engineering information on Dall flow tubes are provided in illustrated Technical Bulletin 115-13. Discusses this metering device from the standpoint of construction, applications, special features. Includes data on working pressures, capacities, accuracy afforded. Also provides installation requirements. Builders-Providence, Inc.

126 Dual Purpose Instrument — Company's new motor rotation and phase tester is described as to application and operation in Bulletin 80. Tells how instrument is designed to determine rotation of electric motors before they are connected to line; phase rotation or sequence of energized power circuits. James G. Biddle Co.

127 For Metering Gas Flow — Bulletin 100-L5, 8 pp, describes application of venturi tubes to measure the flow of gas at large volumes or low pressure. Compares operation with comparable orifice plate installation. Includes orifice and venturi tube computations which form the basis for comparisons for venturi vs orifice head loss. Builders-Providence, Inc.

128 Hydraulic, Pneumatic Controls — Catalog 46, 34 pp, describes and illustrates company's Shear-Seal principle and its application in manual and solenoid valves. Chart shows how to select proper pressure switch. Barksdale Valves.

129 Dynamometer Systems — Bulletin GEA-5923A, a 12-pp revision, tells how company's dynamometer systems can be used for testing internal combustion engines, transmissions, torque converters, rear axle assemblies. Gives data on system's wide speed and torque range ability to meet many testing and measuring needs. General Electric Co.

VALVES, PIPING AND ACCESSORIES

131 Solenoid Valves—Bulletin M-500, 4 pp, illustrated, gives design and performance characteristics of manufacturer's line of diaphragm operated solenoid valves, in six pipe sizes. Drawings show valve's two moving parts — solenoid plunger and synthetic rubber diaphragm — and give valve dimensions. Tables aid in selection of valves for various pressure ranges. Eclipse Fuel Engineering Co.

132 Needle Control Valves — Design operating characteristics, specifications of needle type valves for applications requiring precise control of low rates of flow are explained in 8-pp Bulletin 5C-13. Includes table of nominal needle sizes with corresponding valve coefficients, and characteristic curve showing per cent of maximum flow in relation to per cent of total lift. Gives formulas and instructions for calculating size of control valve for liquids, gases and steam. The Foxboro Co.

133 Lubricated Plug Valves — Reference Book 39-5, 24 pp, shows lubricated plug valves in full-port and venturi types, sizes to 14 in., with a choice of self-sealed two-piece plug or one-piece plug design. Includes principal dimensions, types of control, metals, lubricants. Homestead Valve Mfg. Co.

134 Butterfly Valves — Descriptive and engineering information on fabricated steel and cast iron butterfly valves is provided in a 6-pp illustrated pamphlet (Bulletins 700-5). Discusses construction and operation of these valves designed for control of hot or cold gases and liquids. S. P. Kinney Engineers, Inc.

135 O-Ring Butterfly Valves—Stressing the outstanding features and many uses of company's Mudco O-ring butterfly valves, this booklet provides about 20 pp of data on types available. Accessories are pictured and price list included. Mud Products, Inc.

136 Piping for Permanence — In presenting corrosion fundamentals of plumbing and heating systems, this 32-pp illustrated booklet contains data based on an analysis of thousands of wrought-iron piping systems. Chapters are devoted to requisites of a piping material, building-piping systems, and water and its problems. Includes service records of many installations throughout the country. A. M. Byers Co.

137 For Sealing Joints — Bulletin 18-54 describes Igas, a mastic waterstop which is installed after concrete is placed, to seal joints subject to severe movement and pressure. Sika Chemical Corp.

WATER CONDITIONING

138 Water Conditioning Gadgets — This 8-pp technical paper, titled, "Practical Performance of Water Conditioning Gadgets," contains observations of this company's engineers on various devices used to prevent scale and corrosion in boilers, evaporators, heat exchangers and water piping. References are given describing such devices which have appeared since 1865. Hall Laboratories, Inc.

139 Aids to Heat Transfer — How film forming corrosion inhibitors also aid heat transfer is told in Technical Paper 129. Contains many references to protection afforded by filming amines and the attendant reduction in maintenance costs secured through protection against corrosion. W. H. & L. D. Betz.

. . . Outstanding Among This Month's Catalogs

140 Choosing the Right Valve — Presenting valve selection as a matter of matching the valve's service characteristics with service requirements of the job, this practical 20-pp booklet explains and illustrates basic design features of gate, globe and check valves. It tells, in non-technical language, how each of these valve types works, and where it is suited for use. Disc, stem connection, bonnet and bonnet-joint characteristics are also discussed and the importance of stem operation is treated. A final chapter is devoted to common materials of valve construction. Crane Co.

141 Productive Maintenance — Bulletin GEA-6087, 18 pp, discusses these steps to productive maintenance: gathering of equipment data, determining extent of routine maintenance, establishing a routine operating control system, evaluation for critical maintenance, and establishing a critical maintenance program. General Electric Co.

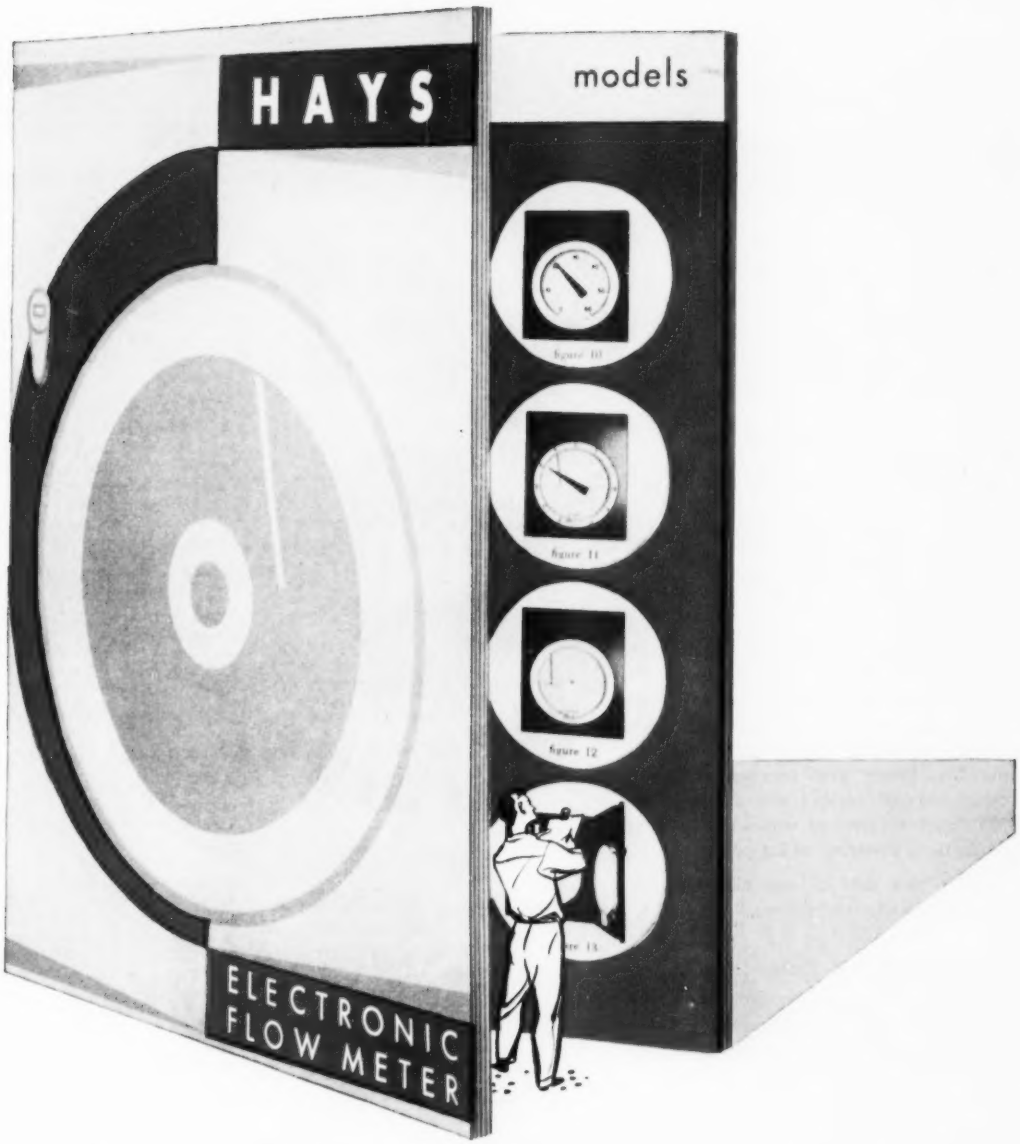
142 Steam Heating Systems — Five major types of steam heating systems, with and without control, and a full line of valves, traps and steam power specialties are described in Bulletin 110, a 20-pp condensed catalog. Features company's Selectotherm system, an automatically controlled high vacuum steam heating system that adjusts its heat output and fuel consumption to outdoor temperature conditions. Also describes systems for installations that are zoned, use steam for purposes other than heating, and use steam supplied by central station. Standard two-pipe vacuum and vapor systems are covered in detail. Illinois Engineering Co., Div., American Air Filter Co., Inc.

143 "Dag" Dispersions at Work — How "dag" colloidal dispersions serve industry is told in 12-pp illustrated Catalog 460. A table lists 40 basic dispersions of graphite, molybdenum disulfide, vermiculite, and zinc oxide in various carriers. Comparative particle size and consistency of each dispersion is given, as well as dilution information and typical applications. Some 108 products and processes aided by "dag" dispersions are mentioned. Acheson Colloids Co.

BOILERS AND AUXILIARIES

144 Package Steam Generators — Twelve-pp Bulletin PSG-1 describes company's Class VV steam generators, portable shop-assembled water tube boilers of simple and compact design and available in capacities from 10,000 to 30,000 lb of steam per hour. Gives design and construction details of the boilers, also capacities, dimensions. Henry Vogt Machine Co.

145 Forced Draft Burners — Catalog Unit Y, 6 pp, illustrated, describes forced draft packaged burners built to specifications for Scotch marine type boilers and other types of heat receivers designed for pressurized operation, for oil, gas or combination firing. Discusses construction and operation of these burners; includes ratings, dimensions. Ray Burner Co.



A guide to better flow metering

Here's a new fact-filled, technical booklet that tells you feature for feature how the new Hays electronic flow meter excels.

Electronic operation — provides maximum accuracy (¼% of full scale differential), and speed (4 seconds for full scale pen travel).

Mercuryless transmitters — rupture-proof metallic bellows for differential pressure measurement.

Continuous integration — motor-driven, continuous mechanical integrator is extremely accurate even on rapid load changes.

Other features include powerful motor, easy readability, accuracy unaffected by normal temperature changes, optional explosion and weather-proof transmitter.

Write for bulletin 54-1074-222 and get the important facts.

Automatic Combustion Control
Boiler Panels • CO_2 Recorders
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Combustion Test Sets
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Electronic Flowmeters
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MICHIGAN CITY 7, INDIANA

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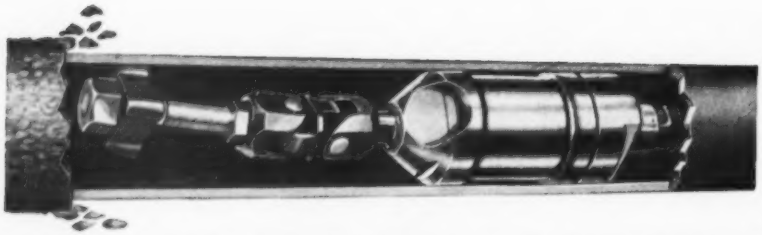


ROTOJET®

Cleans Fire Tubes ▸▸▸▸▸▸ FAST ▸▸▸▸▸▸▸

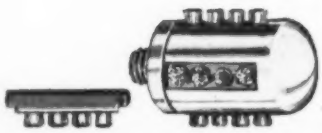
INSIDE *and* OUTSIDE

You can now clean fire tubes inside as well as outside faster with a new Rotojet. The new Rotojet is the most powerful tube cleaner we ever built. It won't stall at low speeds caused by heavy loads. Roto expanding heads and brushes thoroughly clean soot scale inside tubes. A Roto vibrating head (illustrated above) knocks off water scale adhering on the outside.

Try the new Rotojet, and no other tube cleaner will ever satisfy you.

Economical Roto Brushes

Roto expanding brushes and heads have separately replaceable wearing elements. These inexpensive parts save time, money, and critical materials. Send for details.



Roto expanding brush, showing a replaceable brush element. Brings down tube cleaning cost. Maintains high cleaning efficiency.

Roto solid wire brush.

Model S525 ROTOJET Air-driven Motor with swing-frame head for 3" O.D. tubes.

Model S505 ROTOJET Air-driven Motor with 2-arm head for 2" O.D. tubes.

ELLIOTT COMPANY-ROTO DIVISION

147 Sussex Ave. Newark 1, N. J.

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146 Heavy-Oil Burner — Features of this company's new Model 4 Hev-E-Oil burner are stressed in illustrated Bulletin AD-131. Fuel savings afforded, compactness and simplicity of design, starting ease, are discussed. Cleaver-Brooks Co.

HEATERS, HEATING

147 Unit Heaters — Bulletin 7517, 48 pp, presents full information on latest design of this company's Venturafin unit heaters for steam or hot water applications. Gives features of construction, general engineering data, capacity tables. Fully illustrated with photos of horizontal and vertical models, dimensional drawings and piping diagrams, booklet includes tips on selecting heaters. American Blower Corp.

148 Case Studies on Heaters — This brochure of engineering case studies includes nine bulletins, showing how company's counterflo oil or gas fired warm air space heaters were used in diversified manufacturing plants. Industries include paint and glass work, mining, tool construction, others. Dravo Corp.

149 Gas Heaters — How, why and when to use gas-fired unit heaters is outlined in pocket-sized Bulletin SA-541-A, 20 pp. Includes hints on heater selection and installation, schematic diagram explaining how heater works, instructions for estimating heat loss and computing gas requirements. Reznor Mfg. Co.

TURBINES AND ACCESSORIES

150 Industrial Turbines—Mechanical drive turbines rated from 10 to 1200 hp and 1000 to 6500 rpm are described in a revised bulletin, GEA-4955B, 20 pp. Design features as well as applications for pumps, compressors, fans, blowers and other equipment are covered. Generously illustrated, this booklet gives details of the lubrication system, dimensions, procedure for calculating approximate steam rates, governing system. General Electric Co.

151 Turbine Oil Conditioners — Bulletin A-985 analyzes the problem of conditioning turbine oils and describes a line of conditioners. Gives details on basic components of the conditioners. U. S. Hoffman Machinery Corp.

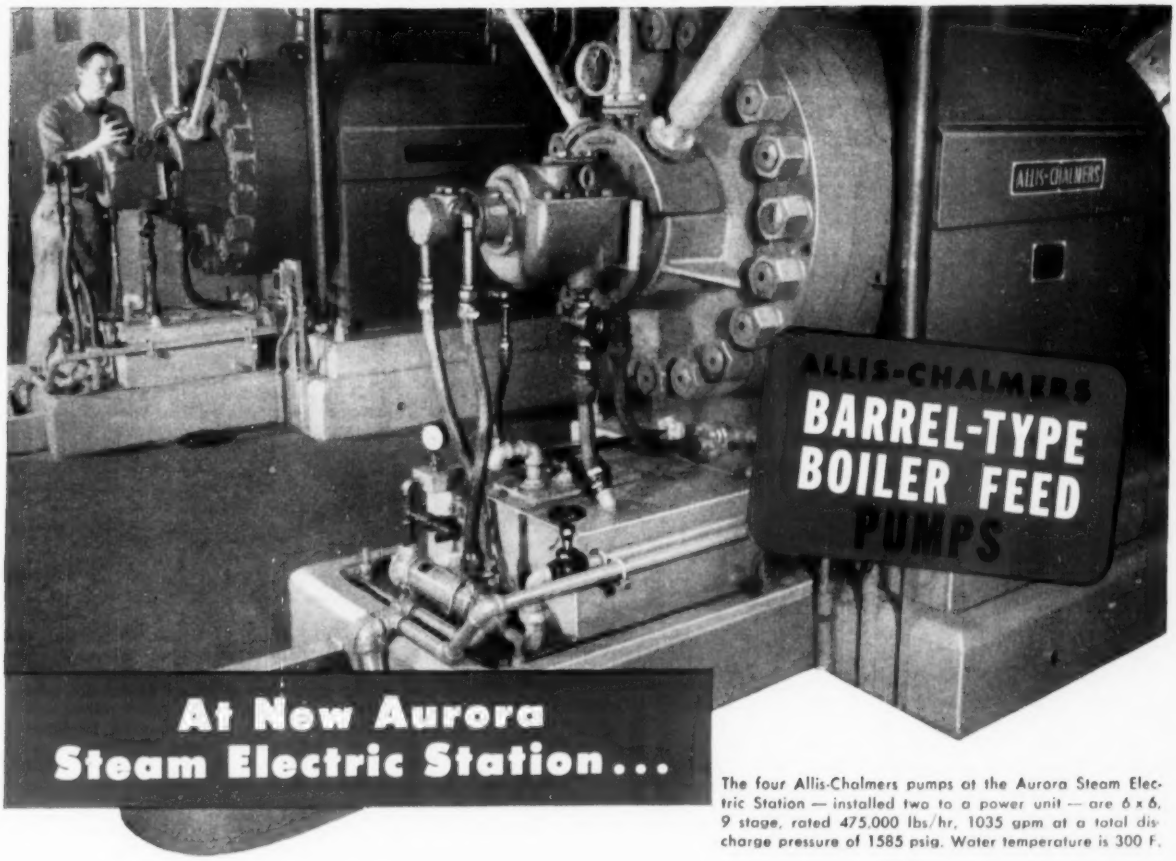
TOOLS, WELDING

152 Timesaving Tools — Sixteen-pp Catalog 35-E covers a line of tools for electricians, plumbers and construction workers. Pictures and gives ordering and application information on pipe and tubing benders, cable pullers, joist borers, knockout punches and cutters, plumbers' bit sets and electricians' auger bits, many others. Greenlee Tool Co.

153 Welding Electrodes—Announced as one of the most complete manuals available on stainless steel welding electrodes, 24-pp Bulletin WE-166 covers in detail the metallurgy of stainless steels. Provides selector tables, other tabular material on welding processes. Describes each of company's welding electrodes as to typical mechanical properties, chemical analysis range of deposited metal, recommended amperage and voltage range. Welding Products Div., A. O. Smith Corp.

REFRACTORIES

154 Fireclay Brick—Bulletin ED-C, 8 pp, illustrated in color, discusses



The four Allis-Chalmers pumps at the Aurora Steam Electric Station — installed two to a power unit — are 6 x 6, 9 stage, rated 475,000 lbs/hr, 1035 gpm at a total discharge pressure of 1585 psig. Water temperature is 300 F.

Minnesota Power & Light Installs 4 of these Highly Reliable Pumps

THE NEW 88,000-KW AURORA STEAM ELECTRIC PLANT at Aurora, Minn., is a model of modern design and efficiency. Equipment was carefully chosen for its ability to provide extra dependable, low-cost operation.

On this basis Minnesota Power & Light Co. — working with its consulting engineers, EBASCO SERVICES INCORPORATED — bought four Allis-Chalmers barrel-type boiler feed pumps.

WHAT ARE YOUR PUMP NEEDS?

Whether you require boiler feed, condensate, circulating or other power plant pumps — a careful study will reveal why more and more utilities are specifying Allis-Chalmers. Check the design features, the operating advantages, the provisions that make a pump easier to maintain, or service. You, too, will find it pays to standardize on Allis-Chalmers Power Plant Pumps.

ONE SOURCE FOR THE ENTIRE UNIT

Allis-Chalmers can supply the complete unit of pump, motor and control — all of coordinated design and manufacture. And you get one responsibility, one reliable guarantee of satisfaction covering the whole unit. A-4407

For detailed information, call your A-C district Office or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for bulletin 08B7899.

ALLIS-CHALMERS

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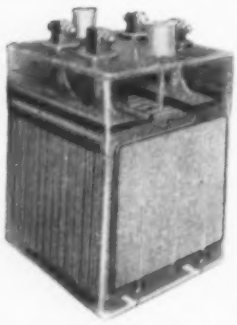

PlastiCell Type PL-29

PlastiCal Type PCL-29

NOW-2 C&D batteries for

Control

Switchgear

Auxiliary Power

Now you can have your choice of *two* modern C&D batteries—specifically designed for control, switchgear, and auxiliary power applications. The two batteries, PlastiCal and PlastiCell, are available in practically any capacity—from 10 A.H. to 770 A.H.

PlastiCal has lead-calcium grids for maximum life—conservatively engineered for 25 years in full-float service.

PlastiCell has positive plates made of high-tensile alloy grid metal for extra life and has a projected life of 14 years in float service. With both PlastiCal and PlastiCell you get:

1 **Extra-long life. Exclusive design combines advantages of both suspended and supported plate construction.**

2 **Triple insulation—thick Fiberglas mat, microporous separators, and perforated Koroseal retainer.**

3 **Saftee Vent—outstanding C&D development that prevents accidental battery explosions.**

4 **Crystal-clear plastic jars—heat-resistant and hermetically sealed.**

5 **Plastite Post Seals—easier maintenance.**

C&D BATTERIES, INC.

of Conshohocken, Pa.

Manufacturers of Industrial Batteries since 1906

Sales and Service Offices in Principal Cities from Coast to Coast

For Details—

Write for new C&D Specification Bulletins:

CP-536 on PlastiCal Batteries

CP-537 on PlastiCell Batteries

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two super-duty fireclay bricks, Alamo and Varnon, giving their advantages. Gives technical details, application information for iron and steel industry, others. Charts indicate refractoriness, porosity, relative loss in panel spalling test. Harbison-Walker Refractories Co.

155 Refractories for Ceramics Industry — This 28-pp booklet is a guide for the selection of suitable refractory materials for specific applications. Includes temperature conversion chart, tables on thermal conductivity and expansion, brick shape combinations required to turn given diameters, conversion factors. Norton Co.

LIGHTING

156 Standard Lighting Specifications — The 1954 printing of "RLM (Reflector and Lighting Equipment Mfrs.) Standard Specifications for Industrial Lighting Units" includes new data on "upward component" lighting units such as coefficient of utilization tables, luminaire distribution data and candlepower distribution curves, plotted at "normal", "parallel" and "45 deg". A 52-pp booklet, this new edition contains latest approved revisions. RLM Standards Institute, Inc.

157 For Emergency Lighting — Bulletin EL-181 describing company's self-contained Nicad emergency lighting unit, lists these advantages: automatic and instantaneous operation upon power failure, neon pilot lights showing readiness and high rate charge, illumination of 10,000 sq ft for two hrs. Nickel Cadmium Battery Corp.

OTHER EQUIPMENT

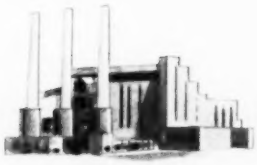
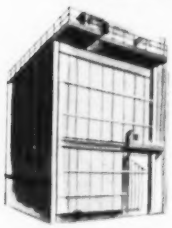
158 Bulk Storage Tanks — How this manufacturer's bulk storage tanks serve many industries is told in this handsomely illustrated 28-pp booklet. Dimensions and capacity data are given for standard horizontal and vertical tanks and those for underground storage. Many installations are pictured, and manufacturer's plant facilities are described. Graver Tank & Mfg. Co., Inc.

159 How to Apply Jacketing — Application instructions on aluminum jacketing for the weatherproofing of insulated lines, towers, vessels, tanks etc. are provided in Folder J-25. Illustrated with detailed drawings, this bulletin gives tips on cutting, lapping, as well as the use of screws and strapping. Childers Mfg. Co.

Postage-free cards for ordering catalogs are on pages 113-114. You may also use the cards to ask for further information on the advertised products.

160 Crawler Tractors — Manufacturer's complete line of diesel-powered crawler tractors is discussed pictorially in "Facts . . . on a New Breed of Tractors," 16 pp. Follows *Time* magazine's format to show operation, special advantages of these crawler tractors. Tractor Div., Allis-Chalmers Mfg. Co.

161 For Improved Sewage Handling — Engineering Manual W-317-B17,

In the 267 new  **central station units being started in 40 different states during the 1953-56 period, 75% of the**  **boilers will be equipped with Consolidated Maxiflow Safety Valves** **...35% will also have** **Consolidated Electromatic Relief Valves. These bulletins** **tell you why.**

Consolidated Maxiflow Safety Valve BULLETIN 707 contains data about the greater discharge capacity, permanent tightness and easily controlled blowdown that make this valve outstanding in safety and service.

Consolidated Electromatic Relief Valve BULLETIN 720 tells how this valve assures (1) more accurately balanced boiler operation; (2) more uniform line pressure; (3) power conservation; (4) less maintenance of spring-loaded safety valves; (5) greater protection against overheating your superheater; (6) increased efficiency for your steam generating plant.

Both bulletins give complete specifications. Write for copies.

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' AND 'AMERICAN-MICROSEN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

For more data circle 522 on Post Card

CONTROL IS VITAL *in Steam Traps too!*

SUPER-SILVERTOPS LAST LONGER

The Patented Guided Bucket Is Controlled by a Hexagonal Tube

Uncontrolled action inside a steam trap causes trouble. In Super-Silvertops every moving part is "guided" in a true engineering manner. The Super-Silvertop bucket, unlike other traps, is carefully directed on a hexagonal tube. This patented arrangement gives Super-Silvertop users proper venting of condensate and air for a longer period of time. All parts are always in perfect alignment . . . the bucket can't hit the side walls . . . valve must close positively and firmly against the seat. That's why Super-Silvertop cuts the cost of steam trapping . . . and reduces trap maintenance.

Insist upon Super-Silvertops, stocked by leading jobbers everywhere.

SUPER SILVERTOPS
The Controlled Steam Trap

Quality Steam Traps Since 1886

SOLVING STEAM TRAP PROBLEMS

Choice of the right steam trap increases efficiency of equipment as much as 35%. This 36-page manual answers problems on sizing, installation and maintenance. Mail coupon for your complimentary copy today.

THE V. D. ANDERSON COMPANY
1977 West 96th Street • Cleveland 2, Ohio
Subsidiary of Chesapeake Industries Inc.

Gentlemen: Please send without obligation a copy of "Solving Steam Trap Problems."

Name_____

Company_____

Address_____

City_____ Zone____ State_____

For more data circle 523 on Post Card

28 pp, describes, illustrates, company's Comminutors for automatically screening and cutting coarse solids in raw sewage. Discusses function, selection, application; includes hydraulic performance charts, dimensions, typical channel designs. Worthington Corp.

162 Steel Mill Power Equipment — Power generation and conversion in steel mills is discussed in Bulletin GER-892, 8 pp, which provides an analysis of steel mill power generating equipment and a discussion of various power sources. Includes data on cost, steam pressures and temperature, size of turbine-generator sets, connections. General Electric Co.

163 For Climate Control — Bulletin 122, 8 pp, introduces an air conditioner designed for precise and economical control of air temperature and moisture. Illustrates design of the new machine, tells its features, and pictures some installations. Tells how it may be used in heating and cooling processes, and how it permits processing of moisture-sensitive materials and the manufacture of a product in any climate at any season. Niagara Blower Co.

164 Continuous-Cast Bronze— How Asarcon 773 continuous-cast bearing bronze can save money in maintenance and production by virtue of its advantages in length, size, machining time, metallurgical characteristics and physical properties is explained in this 6-pp bulletin. Also details the process by which a variety of bronze alloys is cast into rods, tubes and shapes. Continuous-Cast Products Dept., American Smelting and Refining Co.

It's easy to get these free catalogs—just circle item numbers of those wanted on the two post cards provided on pages 113–114

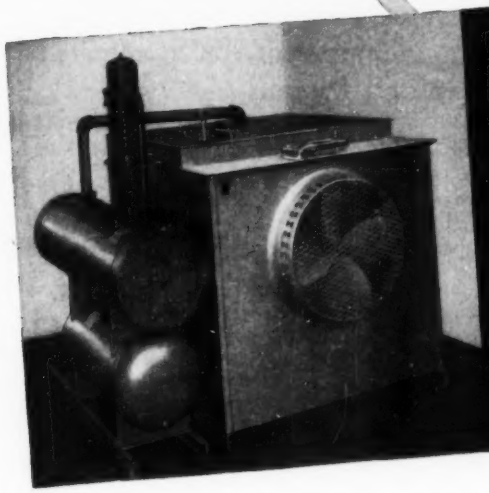
165 Submerged Combustion Equipment — This 18-pp application manual tells where and how to use submerged combustion equipment in various industries. Discusses such applications as concentration of corrosive solutions, heating and oxidizing of asphalt, generation of inflammable gases by cracking recycled stock, and heating large volumes of water. Additions and supplements to manual will be mailed to those who request this original manual. Submerged Combustion Co. of America, Inc.

166 Industrial Plastic—Catalog B-5878, 50 pp, illustrated in color, is a handbook on industrial Micarta plastic, giving all grades and forms in which it is supplied, also chemical, mechanical and electrical properties of each. Color-keyed for easy reference, handbook discusses laminated and molded Micarta, giving design and application information on directional loads, also machining data. Westinghouse Electric Corp.

New

SAVES WATER and CUTS MAINTENANCE COSTS . . .

Illustrations show two views of a 35 ton Condenser Tower prior to partial disassembly for shipment.



Vogt

CONDENSER TOWER

FOR CONDENSING REFRIGERANTS

SINGLE RESPONSIBILITY:

Vogt, leading builder of refrigeration condensers, assumes responsibility for engineering the unit. Only one purchase order needed.

SHOP FITTED:

To cut down field assembly labor. Requires no cutting or fitting of pipe.

Designed for today's water conservation requirements, and to keep refrigeration costs low, the *new* Vogt Condenser Tower meets the need for a proven, readily cleanable condensing unit.

The Vogt Condenser Tower consists of a multipass straight tube condenser, a receiver, an oil trap, a cooling tower, and a water pump. Removable cast iron heads permit easy cleaning of the condenser tubes.

Water costs are extremely low since the cooling water is recirculated continuously and requires only a small amount of makeup to replace losses due to windage and evaporation.

Condenser Tower units are available in capacities ranging from 5 to 50 tons refrigeration. Additional information will be furnished upon request.

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

For more data circle 524 on Post Card

HAGAN

Automatic Control Systems

The many advances in the design of components and the arrangements of Hagan Automatic Control Systems are the result of thirty-five years of experience with all types of control problems.

The accuracy, dependability and versatility of each unit permit Hagan engineers to select the right combination of equipment for coordinated accomplishment of every function required of a system.

The following are just a few of the services for which successful applications have been made.

Automatic combustion control for boilers of any size or pressure, firing all types of fuels, singly or in multiple.

Boiler drum water level control, with automatic compensation available for boiler load or water density.

Draft or pressure control over a continuous range from fractions of an inch water column to 5000 psig.

Superheated steam temperature control.

Steam pressure and temperature control for all types of reducing and desuperheating stations.

Controls for air preheated temperatures.

Feedwater heater pressure or temperature controls.

Controls for parallel or sequential operation of fans, blowers or pumps.

HAGAN
HALL
BUROMIN
CALGON

HAGAN

Ring Balance Instruments

When you buy Hagan Ring Balance Instruments, you choose the most versatile units available for the service involved. The following are some of the factors which make this a reality:

Interchangeable sensing elements for full scale differentials from 1" to 560" WC.

Full scale range of each element adjustable over 7 to 1 ratio.

Dead weight calibration check can be made without disconnecting the meter from the line.

Spring resistance system produces reliability at lower flow ranges.

Mercury level is not critical.

No stuffing boxes or pressure-tight bearings.

Ample operating power at all rates of flow.

The breadth of application of Hagan Ring Balance Meters is indicated by these successful installation types.

Recording, indicating and integrating flows of water and steam, or liquid and gaseous fuels.

Simultaneous records of two separate flows, measured in a single meter housing. Flows may be added or subtracted for accounting and distribution purposes.

Pressure and temperature compensated records of steam and gas flows.

Pneumatic or electric signal transmission available.

Density compensated recording of boiler drum water level.

Density compensated recording of gas or liquid flows.

Flow ratio control for liquids and gases.

Remote recording, indicating and integrating.

Our engineers will be glad to suggest the Automatic Control and Instrumentation best suited to your requirements.

HAGAN CORPORATION

HAGAN BUILDING PITTSBURGH 30, PENNSYLVANIA

Boiler Combustion Control Systems • Ring Balance Flow and Pressure Instruments • Metallurgical Furnace Control Systems • Control Systems for Automotive and Aeronautical Testing Facilities

For more data circle 525 on Post Card

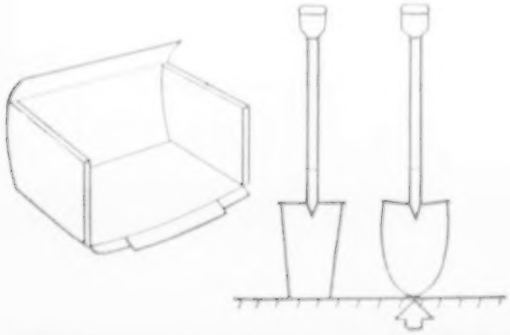
Compare these coal-handling

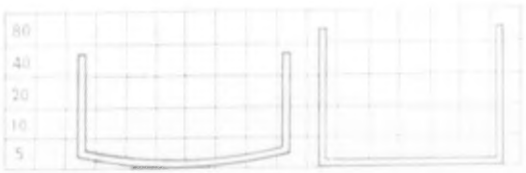
PENETRATES FASTER

Curved and offset cutting edge on Allis-Chalmers Motor Scrapers concentrates all the horsepower on the center section during initial penetration. The penetrating ability of a round-end spade helps illustrate the practical soundness of this Allis-Chalmers design.

LOADS FASTER

Low, wide bowl plays an extremely important part in ease of loading. Tests have proved that loading resistance is largely determined by the height to which the load is built. New coal entering the bowl must lift the load directly above it in order to make room for itself.





This chart shows how loading resistance continually increases as the load builds up . . . how the lower, wider bowl of an Allis-Chalmers Motor Scraper requires less time and power to get the same load.

PERFORMANCE MAKES DOLLARS

features before you buy

Check over these features of the Allis-Chalmers TS-300 Motor Scraper, point by point. See for yourself the sound reasons behind its design. Compare it feature for feature, dollar for dollar with any machine in its class, and we believe you'll agree that this TS-300 is the *number one* Motor Scraper value for coal handling.

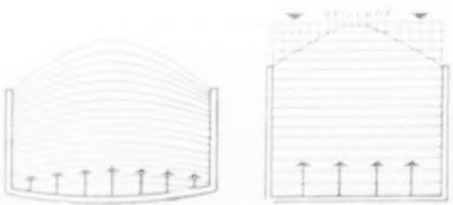
Its 4th gear speed of 22.5 mph and heaped capacity of 13½ tons (18 yd) means efficiently moving big quantities of coal long distances. Big horsepower-to-load ratio — 20.7 hp per ton (heaped) — contributes to fast loading and big loads. Its weight of 47,900 lb (empty) helps compact coal to avoid fire by spontaneous combustion. Note also the features illustrated below which mean better performance all through each trip.

Your Allis-Chalmers dealer will be glad to show you a Motor Scraper at work — in fact demonstrate one right on your own coal stockpile. We suggest you see him or write us for more information.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

HEAPS AUTOMATICALLY

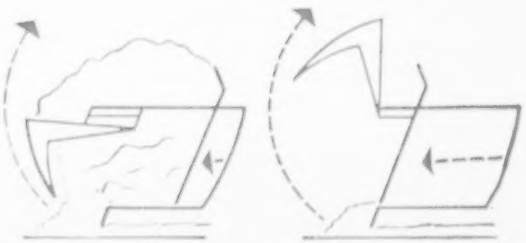
The combination of slightly deeper center cut and correctly angled cutting edge shapes the load as the scraper fills. The greater volume of coal flowing into the center of the bowl "boils" forward, to the rear and to the sides, producing an automatically heaped load without excessive spillage.



These diagrams show how an automatically heaped load avoids costly spillage even though the center is built up above the sides of the bowl.

SPREADS EVENLY

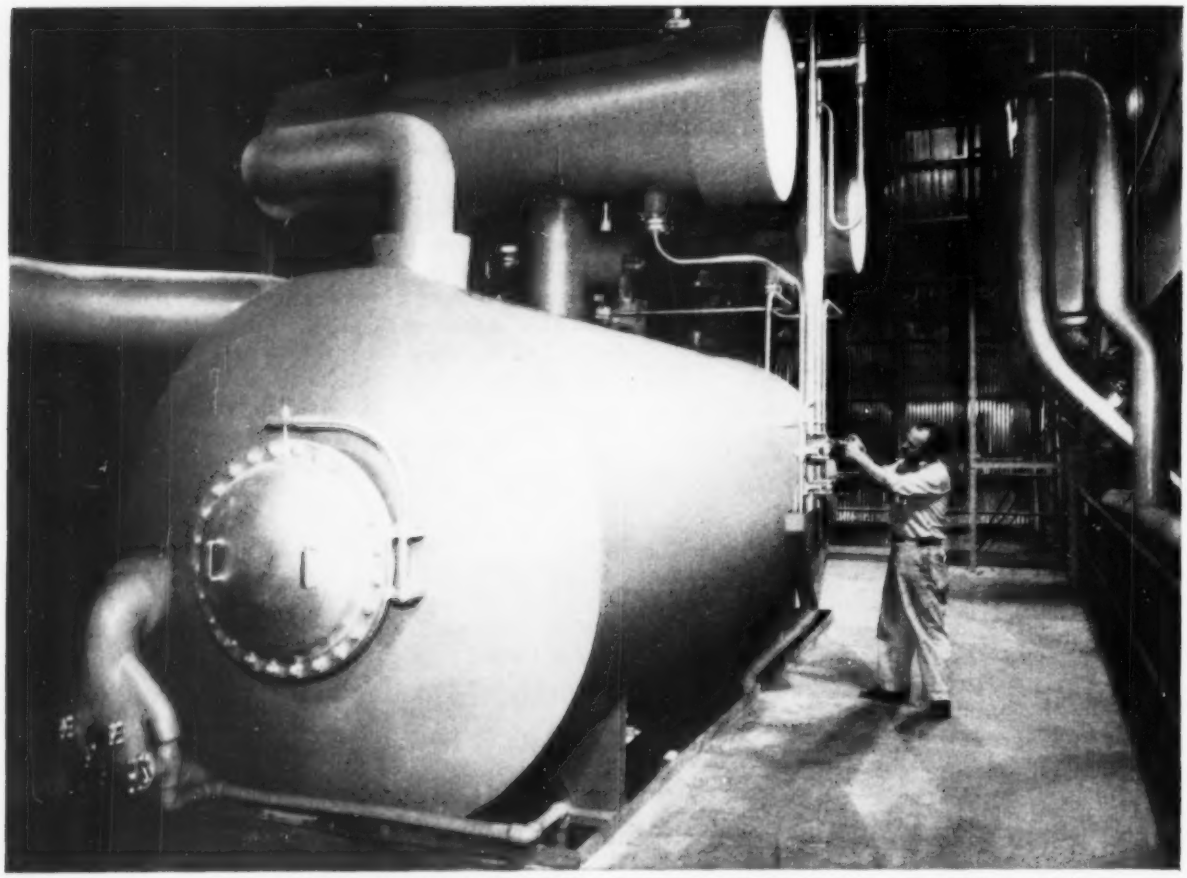
Forward movement of ejector is timed with lifting action of apron, which provides a continuous flow of coal to insure a smooth, even layer.



High apron lift prevents any possibility of material's jamming. Even when loaded from overhead, anything that can be put into the bowl can be easily ejected.

WHEN DESIGN MAKES SENSE

For more data circle 526 on Post Card



ONE OF SEVEN WORTHINGTON DEAERATORS installed by Stone and Webster Engineering Corporation, engineers and constructors for Virginia Electric's growing power system.

Now there are seven Worthington deaerators at Virginia Electric and Power Company

Back in 1939, the Virginia Electric and Power Company first started buying steam power equipment from Worthington.

Since that time, VEPCO has installed seven Worthington direct-contact deaerators in new or existing stations, the latest deaerator going to work in 1953.

There's a good reason for all this repeat business — *performance*. Worthington deaerators, like all Worthington steam power equipment, are built for service, built to keep going year after year under the most rigorous operating conditions. Features like easy tube accessibility, Worthington's patented tray system and specially designed distributing weirs add up to economical, dependable operation — with extremely low maintenance costs. Matter of fact, we think our deaerators are the best salesmen we have.

Get in touch with your nearest Worthington district office for bulletins and information. Or write to Worthington Corporation, Steam Power Division, Section S.4.1, Harrison, New Jersey. S.4.1

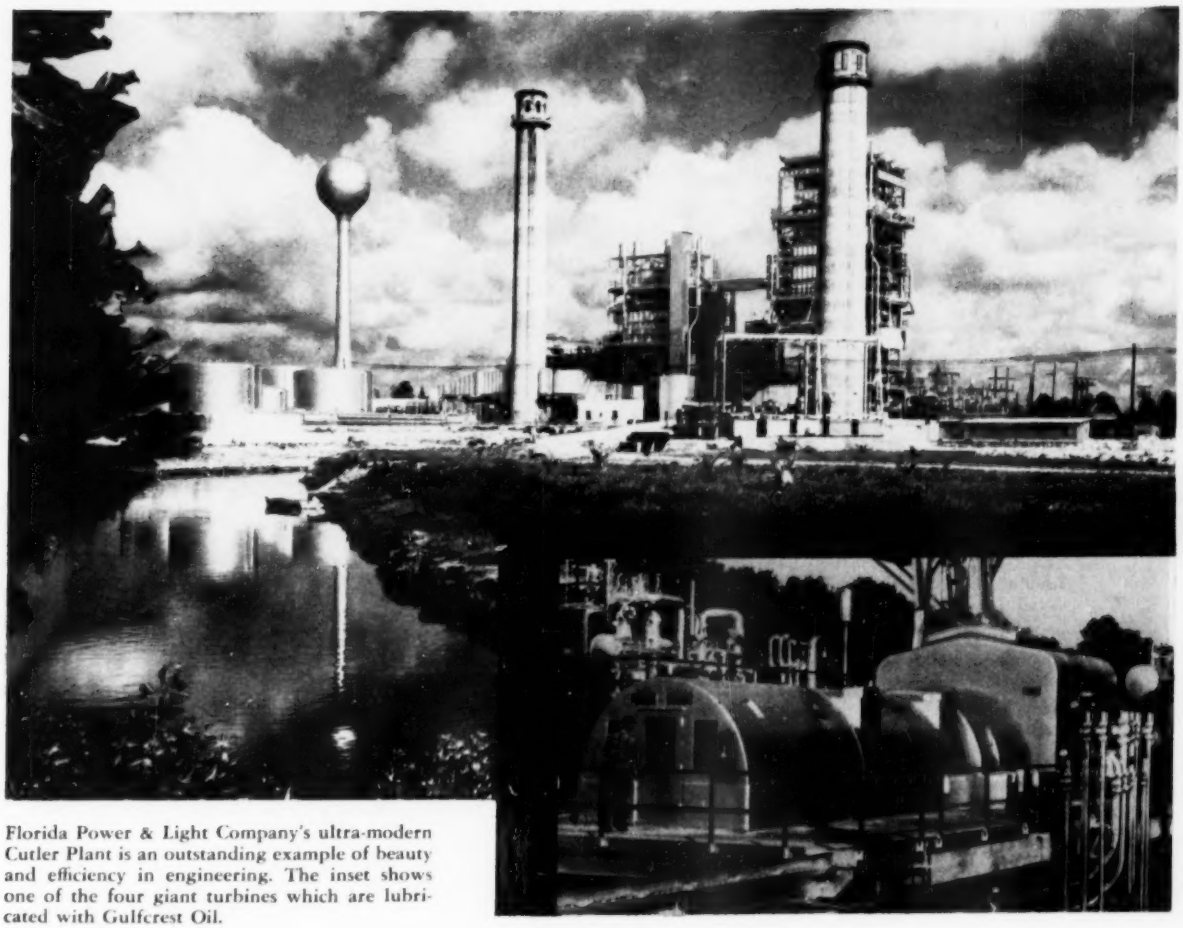
WORTHINGTON

A GREAT TEAM IN STEAM

Steam-Jet Ejectors and Vacuum Pumps • **Boiler Feed Pumps** • **Deaerators** • **Steam Turbines** • **Surface Condensers and Auxiliaries**

For more data circle 527 on Post Card

Gulfcrest Oil selected for Florida's newest and largest power plant



Florida Power & Light Company's ultra-modern Cutler Plant is an outstanding example of beauty and efficiency in engineering. The inset shows one of the four giant turbines which are lubricated with Gulfcrest Oil.

Setting the pace for Florida's phenomenal economic growth is the Florida Power & Light Company which serves 452 thousand customers in the Sunshine State. Included in its current $332 million expansion program is the giant new Cutler Plant—largest in the state.

The four huge generators (whose capacities total 160,000 kilowatts) and auxiliary equipment in the Cutler Plant are lubricated with Gulfcrest —the world's finest turbine oil.

Gulfcrest Oil was not chosen at random for this important job. It has a background of superior performance in other Florida Power & Light Company plants, as well as in scores of other prominent utilities in Gulf's marketing territory.

In many installations Gulfcrest has been in service over 15 years without any significant change in its original characteristics, and with neutralization numbers always remarkably low.

You'll be joining an impressive group of satisfied users when you fill your turbine system with this outstanding oil.

Your nearest Gulf office has a Gulf Sales Engineer always available to recommend the proper grade of Gulfcrest Oil for your turbine. Call him today, or write to the Gulf Oil Corporation, 1822 Gulf Building, Pittsburgh 30, Pa.

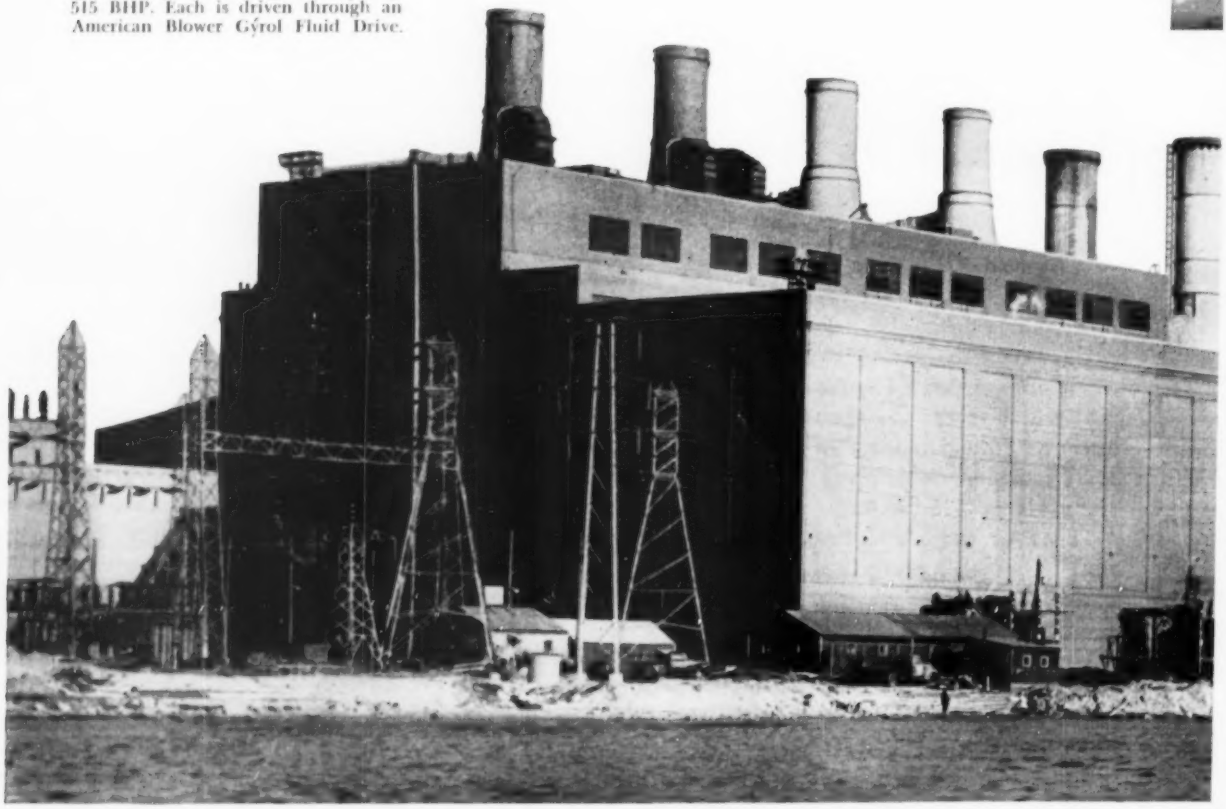
GULF INDUSTRIAL LUBRICATION

For more data circle 547 on Post Card

Niagara Mohawk expands

Installed at Niagara Mohawk's Oswego Station are two American Blower Induced Draft Fans, rated 181,000 cfm @ 310°F @ 14.0" SP @ 1150 rpm @ 515 BHP. Each is driven through an American Blower Gyrol Fluid Drive.

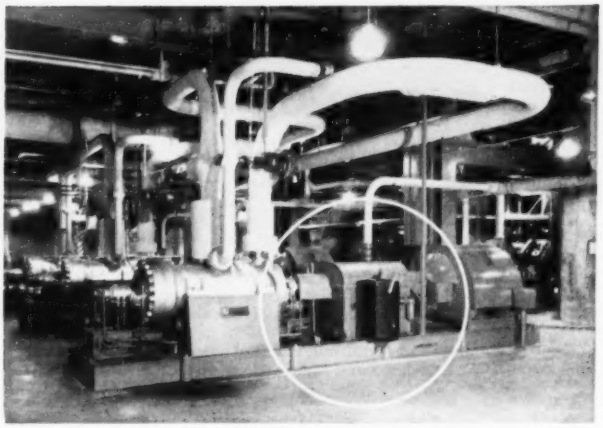
Installed at Dunkirk Station are American Blower secondary air fans with inlet vane control. Rated capacity, 112,000 cfm, 12" wg, 1190 rpm.



Serving home and industry: **AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL**

capacity to 2,682,000 kw

American Blower Reports on Progress in Power



American Blower Gyrol Fluid Drives control the speed of Boiler Feed Pumps at Dunkirk Steam Station. Rated capacity of each Fluid Drive is 1,250 hp at 3,500 rpm. Niagara Mohawk also uses Gyrol Fluid Drives for fan control.

Niagara Mohawk Power Corporation is one of the world's largest private producers of electrical power. With 84 hydro-electric and seven steam-electric stations, Niagara Mohawk serves a 22,000 square-mile territory in New York State, and supplies electricity to 3,100,000 people.

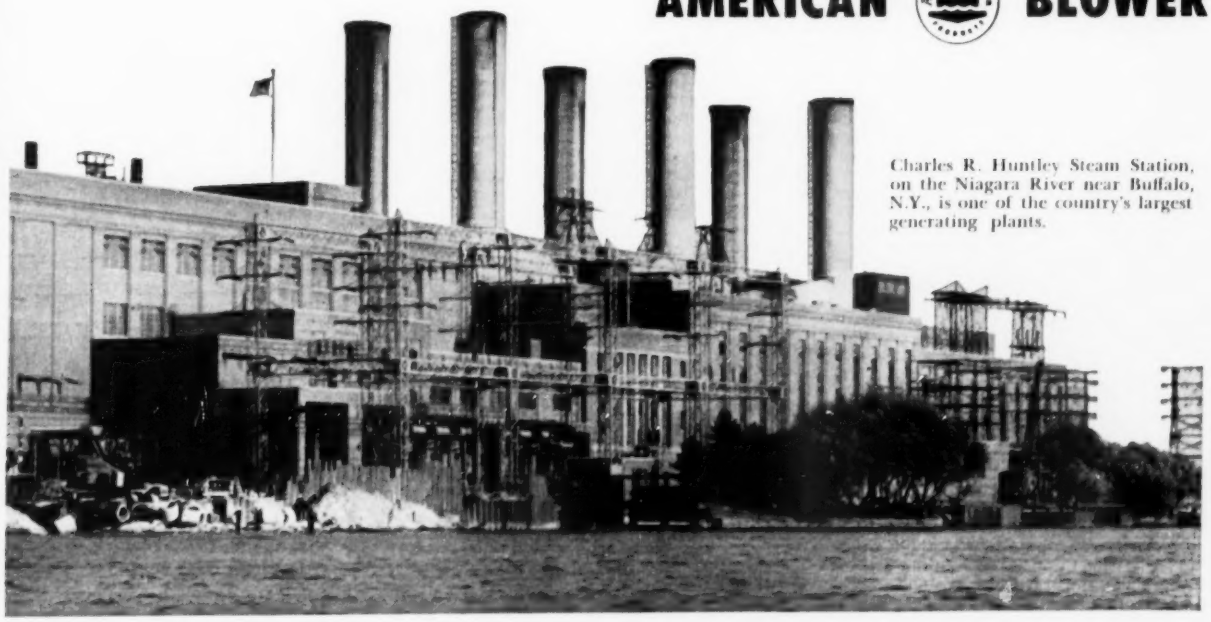
To keep pace with the growing power needs of its customers, Niagara Mohawk has spent a total of nearly $350,000,000 for new and expanded facilities since the war. During 1953 and early 1954, approximately 300,000 kw of generating power were added, bringing the system's total rated capacity to a mighty 2,682,000 kw.

American Blower has played an important role in this expansion program. It has supplied many of Niagara Mohawk's Stations with Mechanical Draft Fans and Gyrol Fluid Drives for boiler feed pump and fan control. Recognized for its dependability and economy of operation, American Blower equipment — including Dust Collectors, Fly Ash Precipitators and Heavy Duty Steam Coils, is used exclusively in power plants throughout the country.

If you are planning to expand or modernize your facilities, get in touch with your nearest American Blower Branch Office, or write us direct. We will be pleased to work with you on your air-handling problems.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, CANADA
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER



Charles R. Huntley Steam Station, on the Niagara River near Buffalo, N.Y., is one of the country's largest generating plants.

TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

For more data circle 529 on Post Card

EQUIPMENT NEWS

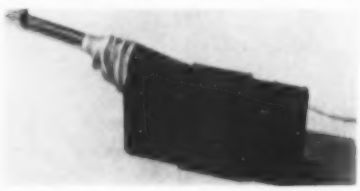
Described here are new and newly improved products. Use the Reader Service Cards on pages 113–114 to ask for more information on them. Just circle item numbers of all the products in which you are interested.

1—DRY FILM COATINGS have epoxy resin base

Two new "dag" dispersions, No. 213 (containing colloidal graphite) and No. 223 (containing colloidal molybdenum disulfide), offer advantages of epoxy resins as a base for dry, lubricating coatings. Films formed with these dispersions are said to show excellent adhesion and wear-resistance, to be unaffected by oils and solvents, and suitable for use where temperatures do not exceed 500 F. All types of surfaces, whether or not pretreated, can be coated with these dispersions, it is noted, and when applied according to manufacturer's recommendations they offer corrosion-resistance and lubrication. Acheson Colloids Co.

2—IMPULSE GENERATOR for many applications

The Series B7000 Impulse Generator — announced as the first of its kind — converts mechanical energy into pulses of



electrical energy. Originally developed for military use, its industrial applications include use in alarm systems, operation of solenoids, or wherever an electrical impulse is required and only slight mechanical force is available. The unit is self-restoring after operation without application of additional mechanical force. The impulse generator is said to operate successfully under water without impairment of electrical characteristics.

No maintenance or adjustment is required, says company; the generators possess no stored potential energy to cause premature or unintentional operation. Size, shape and weight of the generators may be varied to meet operating requirements of space, mechanical force input, desired electrical energy output and weight. They are also available hermetically sealed. Microloc.

3—PANEL INSTRUMENTS designed for high visibility

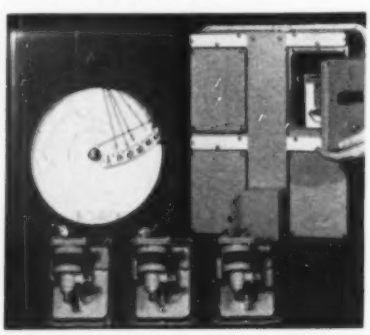
Clear plastic fronts and in-line pointers and dials are features of the Model 610 group of 4½-in. switchboard and panel instruments. The plastic fronts are designed to admit maximum light on the dial from the sides, top and front, and thus eliminate need for internal illumination under normal operating conditions. The in-line pointer and dial, in which the scale is raised in plane with the pointer tip, serve to eliminate parallax errors and permit accurate readings at an angle. Lower portion of the plastic front is normally black, but other colors can be furnished. The instruments can also be furnished with black Bakelite fronts, with or without in-line pointers and scales. At additional cost, internal illumination can be furnished on the Bakelite instruments with flat dials. A bulletin covering the new line gives prices and additional data. Weston Electrical Instrument Corp.

4—RECORDER has plug-in receivers, year's automatic inking

A receiver recorder for pneumatic and electric transmission systems in power and process plants, this instrument is designed to record any measured variable which may be converted to pneumatic or electric signals. It keeps continuous, independent records of one to four pneumatic and electric transmissions in any combination. Plug-in precalibrated receivers make this possible.

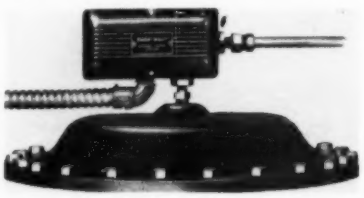
The receiver units (shown in the foreground of the picture) may be plugged into rear of the recorder casing (right) to form any combination of one to four records. These units may be added or interchanged for adaptation to new or revised metering and control applications. Two plug-in escapement-type integrators may be included in the same casing with two flow records.

Fountain type recording pens provide continuous feed a year without refilling. The new recorder is designed for panel mounting, requiring a cut out only 14 by 17 in. Panel bolt holes and studs are not required. Recorders are available in green, buff, gray or black baked enamel finish. Bailey Meter Co.



5—POWER RELAY for use in pneumatic systems

The Autronic Type P2R Power Relay is described as an electro-pneumatic transducer designed to operate with company's Autronic Control System to eliminate transmission lags. It takes the electrical output from the Autronic Controller or manual control and converts it to an air-loading pressure proportional to the electric current. As manufacturer points out, this makes it possible to utilize the low cost and flexibility of air-operated valves without the transmission lags normally encountered in all-pneumatic systems. The equipment can be made explosion-proof.



This relay operates on the null-balance principle in which a mechanical force is balanced against the force produced by the air-output pressure from the pneumatic pilot. Maintenance of this relay is said to consist mainly of occasional cleaning of the pneumatic pilot and booster relay. A bracket is provided for wall mounting; or the relay may be mounted on the valve by means of the pipe connection to the valve diaphragm chamber. The unit can be used reverse or direct acting. The Swartwout Co.

6—TAPING GUN speeds up electrical harness wrapping

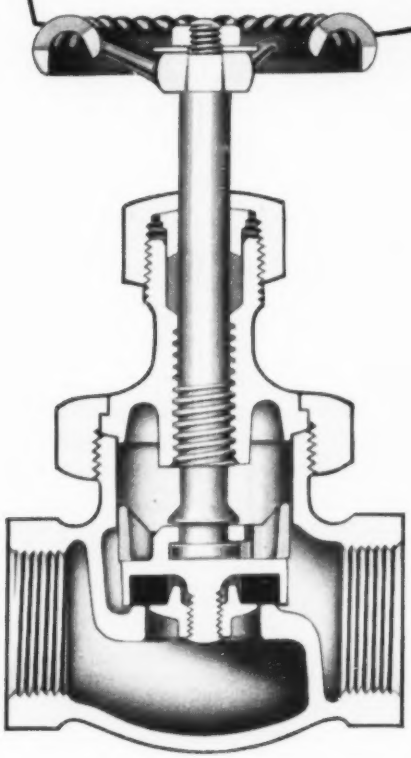
Scotch Taping Gun E-2 is specifically designed for use with company's ⅜-in.-wide Scotch brand plastic electrical

tape, No. 33. Weighing less than 20 oz, with a 36-yd roll of tape in the circular magazine, this gun lets you bundle wires and cut the tape in one quick and easy motion. In use, the tape protruding from the gun is stuck to the wires by the thumb, threaded around the bundle by the curved tip, and then cut with a touch of the thumb button. The end of the tape is pressed down to complete the wrap. The slender, 10½-in. curved tip serves as a convenient "needle" to thread the tape around the wires on a cable layout board or in hard-to-reach spots. Minnesota Mining and Mfg. Co.

7—RAMFEED STOKER is bin-fed, package unit type

This new model is a unitized design incorporating manufacturer's Flo-Tube Conveyor and Ramfeed Stoker of either

A New Disc . . .
A "New" Valve



Crane No. 7 Brass Valves with quick-change composition disc

Save time, trouble, and money by standardizing on these Crane quality 150-Pound Valves. Simple to service. No big inventory of replacement parts. Just a few extra disc holders . . . a supply of composition discs. That's all you need for a wide variety of fluids . . . and an economical maintenance program.

The composition disc takes most of the normal wear—stands up well under ordinary usage—seats easily even on air and gas—absorbs foreign particles that might cause leakage in metal disc valves. When a leak shows up, make a "new" valve—with a new disc. Simply dismantle the union ring, lift out the trimmings, replace the disc holder assembly. Takes only a few minutes. Save the disc holder you removed—use it with the next replacement disc.

Rugged construction throughout. Sturdy bonnet joint, well reinforced by heavy union ring—can be repeatedly dismantled and reassembled. Get better acquainted with the Crane No. 7 line . . . for steam, hot and cold water, air, oil, gas, gasoline, and many other fluids.

GLOBES, ANGLES, AND CHECKS

Ask for folder AD-1682R—contains full facts on the No. 7 brass valve line and the companion No. 27 check. Your Crane Representative has a copy for you—or write direct to address below.

No. 7 Globe
Sizes ⅛ to 3-inch

No. 7 Angle
Sizes ⅛ to 3-inch

Specify No. 9 for Flanged Ends

No. 27 Check
Sizes ¼ to 3-inch

THE BETTER QUALITY . . . BIGGER VALUE LINE . . . IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

For more data circle 530 on Post Card

Vulcan or LoSet type. It is claimed dust-free, and designed to convey coal direct from storage to furnace without manual attention. When equipped with bin level controls, it automatically starts when the hopper is empty, and stops when the hopper is full. The flow of coal to the furnace is pro-rated by automatic controls according to the steam demand, it is explained, and the only attention necessary is the removal of ashes once or twice a day. The stoker can be equipped with ash quenching pipes to make the ash removal dust-free.

According to manufacturer, the cost of this stoker is low, and little power is required. It can be installed from the front, side, or rear of the boiler. Combinations of horizontal and inclined conveyors can also be supplied where two or more hoppers are to be supplied with fuel. Canton Stoker Corp.

8—WET COLLECTOR for difficult dust control jobs

The Type CW-1 is a centrifugal wet dust collector designed for dust control problems which cannot be solved by cloth type collectors — including temperature or moisture; explosive or combustible dusts; corrosive, highly abrasive and/or obnoxious dusts; and combinations of the foregoing.

Of counter-current design (air flow counter current to water flow) and tower type construction, it consists of multiple wet vane sections and a final water entrainment vane section. The diameter of the collector varies in proportion to the air volume handled and the number of wet vane sections is governed by application requirements. The water supply enters above the top wet vane section and flows downward, or counter to the upward flowing air, which enters the collector through the lower tangential inlet.

This design is claimed to provide greatly increased impingement surface and impart vigorous centrifugal action to both air and water to produce thorough intermixing. Increased capacity is obtained in reduced space, says company, and channeling is prevented. Water and dust are discharged as sludge from the lower cone and clean air from the top outlet. After clarification in settling tanks, the water may be recirculated. Pangborn Corp.

10—ALUMINUM PAINT for metal surfaces up to 1000 F

Hot Surface Aluminum SP-415 combines fine aluminum paste with a special vehicle and is shipped in double compartment containers. Applied to surfaces while warm, it is suggested for use on boilers, pipes, heaters, flues, retorts, heat exchangers and similar surfaces subjected to heat. It may be applied by brush or spray and takes 2 hr to dry when applied to warm surfaces. A gallon of this aluminum paint covers about 500 sq ft. United Laboratories, Inc.

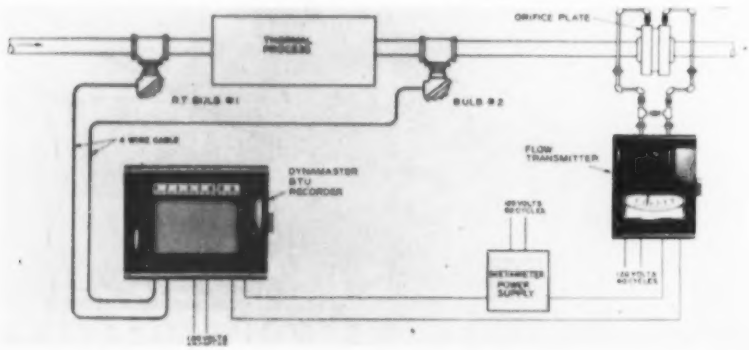
11—PAINT adheres to galvanized iron and zinc surfaces

Zincoater, a paint formulated to firmly adhere to galvanized iron or zinc surfaces, combines metallic zinc dust with a phenolic resin vehicle and tung oil. The result is a durable gray finish that can be covered with enamels or other paints. Manufacturer says there is no harmful chemical reaction between Zincoater and either the galvanized surface or finish coat. It may be applied by brush, roller or spray, dries in two hours. One gal covers about 700 to 800 sq ft when brushed on. Available in 1-gal cans, it is packaged in a two-compartment container for convenient mixing. Unmixed portions remain stable, says company. The Tropical Paint & Oil Co.

9—BTU RECORDERS measure the rate-of-heat input or output

Fast, continuous measurement and control of rate-of-heat input or output is declared possible with the Dynamaster Btu Recorder-Controller Systems. These can be used to measure and record the quantity of heat supplied to or drawn from process vessels, refrigerating plants, air conditioners and many other heat-exchanging devices. Control apparatus is available for regulating temperature or flow-rate of the heat-transfer medium.

In the basic recording system, one Dynamaster measures the temperature difference with two resistance thermometer bulbs and receives the flow-rate from a flow transmitter. From the two variables, it then continuously computes and records the Btu product. Other systems provide for recording temperature difference along with Btu on a single round or strip chart by a single two-pen Dynamaster; recording of Btu and either flow rate or temperature difference by two separate instruments. In most instances totalizers can also be furnished. Matched resistance bulbs are not required — an optional bulb trimming adjustment lets the user install a replacement bulb and match it to the system. The Bristol Co.



12—INTERCOM SYSTEM needs neither cable nor installation

Announced as the first completely selective wireless intercom system, the Talk-A-Phone LCM-8806 offers many features of this company's conventional line, including a six-channel selector, which enables each unit in the system to transmit to any of six separate channels and receive calls on any channel it selects. As many as three separate conversations can be carried on simultaneously over the six-station system, according to manufacturer. Wireless selective communication, enabling any master to

converse with any other master separately, is another feature.

Conference calls between masters, as well as company's Uni-Trans feature which provides for dictation, or one way transmission without continued manual operation, are offered in the LCM-8806, as well as the Sonic-Gate Circuit, which suppresses line noises and hum. The new model is adaptable for additional master units; it plugs into a conventional electric outlet. Talk-A-Phone Co.

13—TEFLON BELLOWS offered with companion flanges

Chemically inert, corrosion and heat resistant bellows made from Teflon are now available with companion flanges conforming to American Standard bolt hole circles and numbers for pressures to 125 psi. They can be supplied to fit pipe from $\frac{1}{2}$ through 12 in. The bellows feature a new convulation form which is said to afford greater strength, longer life and increased flexibility. It is pointed out that since they retain formation at full free length, they are subjected to minimum residual and working strain. They expand and contract in either direction. Operating temperature range is — 94 to 500 F.

The bellow flanges are of French-type gasket construction for good sealing at lower flange pressure, and gasket insert material is asbestos or synthetic rubber. Typical applications for these bellows include vibration dampeners, expansion joints and connectors. They come in designs suitable for metering pumps, pressure accumulators, batching systems. Crane Packing Co.

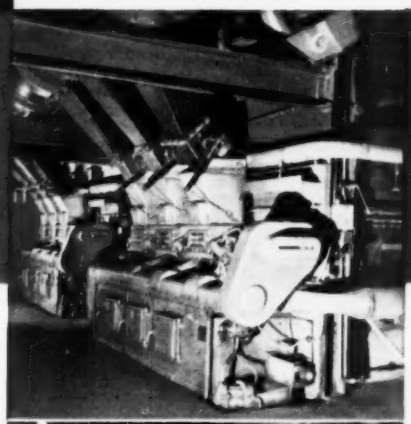
14—BURNER UNIT, for heavy oil, in 15 to 175 gph capacities

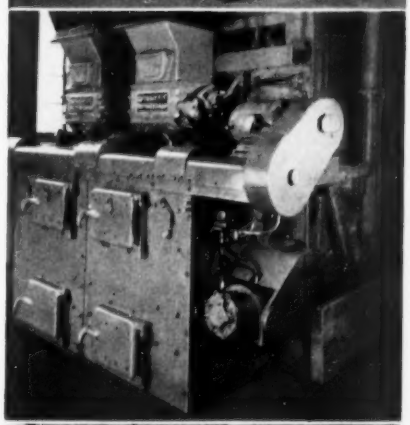
The Model BHE is a rotary heavy oil burner unit in which are integrated the combustion system proper, company's Voluvalve with equalizing valve, and low density electric oil preheater. It is available with or without a panel box containing complete control assembly. This burner unit is designed for preheated residual No. 6 fuel of viscosity between 45 and 300 SSF at 122 F. It is wired and

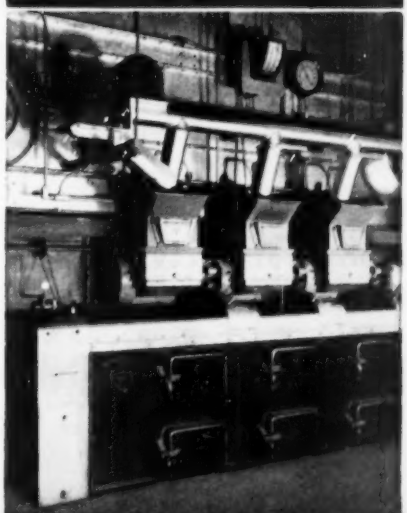
DETROIT ROTOSTOKER TYPE C-C *(continuous cleaning)*

Makes a Hit WITH ENGINEERS

They're buying Detroit RotoStokers Type C-C because of these exclusive features:







- Cleans Fuel Bed and Discharges Ash Continuously at the Front
- Smokeless Operation Through Wide Load Range
- Efficiently Burns Bituminous Coals and Lignite
- Insures Continuous uninterrupted Steaming Capacity and High Availability
- Responds Quickly to Fluctuating Loads
- Fuel Feeders Handle High Moisture Coals Easily and Without Clogging
- Operation Automatic and Dependable
- Easily Applied to Existing Boilers—No Basement required
- Design Results in Low Maintenance
- Sizes Available to Develop from Approximately 5,000 to 75,000 Pounds of Steam Per Hour

DETROIT ROTOSTOKER TYPE C-C

Detroit RotoStoker Type C-C (continuous cleaning) installed or ordered for Steam Plants of:

Allied Chemical & Dye Corporation
Alpena Power Company
Auto-Lite Battery Corporation
Columbian Carbon Company
E. I. DuPont de Nemours & Company, Inc.
Frankenmuth Brewing Company
General Motors Corporation
Motor Products Corporation
National Gypsum Company
State of South Dakota
U. S. Atomic Energy Commission
U. S. Steel Corporation
Wake Forest College
Walter Brewing Company

DETROIT STOKER COMPANY

GENERAL MOTORS BLDG.
DETROIT 2, MICH.
Works at Monroe, Mich.
District Offices in Principal Cities

6879

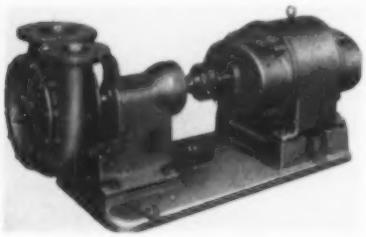
assembled, ready for installation. Capacities range in 10 sizes from 15 to 175 gph.

An outstanding feature of this unit is the equalizing valve built into the fuel pump reservoir along with the fuel volume, metering delivery control valve (the Voluvalve). This equalizing valve is said to improve automatic starts on No. 6 oil and to be especially effective in improving combustion at all firing rates, where catalytic No. 6 oils have not been raised to the temperatures required for complete combustion. It is also claimed to reduce noise cause by burning heavier oils at too low temperatures.

Because of the equalizing valve, a low density electric heater may be used, company explains, and this provides larger electric heating capacity, so that, with a 20 psi spring loaded valve in the line between heater and burner, the temperature of the oil to the burner may be raised to that found best for burning. Preferred Utilities Mfg. Corp.

15—CENTRIFUGAL PUMPS for handling of corrosive liquids

Centrifugal pumps in this company's new Fig. 3715 series are available with the entire fluid end in 316, Gould-A-Loy



20 or 304 stainless steels, all iron, all bronze, bronze fitted, iron with stainless trim, or bronze with stainless trim. They are of support-head construction, with the support cast integral with the bearing housing. The maximum liquid operating temperature has been raised to 350 F, with provisions for water cooling of the support head and gland quenching.

In these pumps, the stuffing box is on the suction side of the impeller, and so is under suction pressure only. This, manufacturer points out, promotes long packing life and keeps leakage to a minimum. The pumps are built in nine sizes from ¾ to 3 in., providing capacities to 720 gpm, heads to 200 ft. Additional details and performance data provided in Bulletin 725.4. Goulds Pumps, Inc.

16—MAINTENANCE COATING has good corrosion resistance

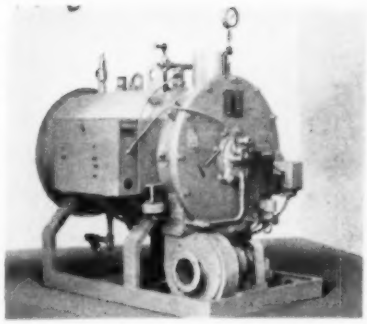
Magic-Vulc Neoprene Maintenance Coating 245-B is a thick, paint-like liquid of high solids, which may be brushed or sprayed on most surfaces — without primer or accelerator. It is described as a "one-shot" or one-solution product, ready to use directly from the can and having long shelf life. Black is standard, but aluminum and other colors are available.

According to manufacturer, this coating dries in 2 hr and gives a thickness of 5 to 10 mils, the dry film forming a tough, adherent protective coating. Coverage is 75 to 100 sq ft per gallon. It is claimed resistant to water and chemical solutions under conditions of total immersion; to adhere to metal, concrete, wood, plastic, and glass; and to resist action of oils, alkalis, strong sunlight and sea water. Also, since the coating is elastic as well as tough, it won't crack under extreme weather conditions or rapid temperature changes, it is pointed out, and it's easily repaired if damaged.

The new coating is suggested for protection of steel structures and equipment, tanks, blowers, housings, ducts, fume hoods. It is also declared suitable as an anti-skid coating, caulking compound, formed-in-place gasketing, pulley lagging, resurfacer for worn conveyor belts, and other maintenance uses, including repair of electric cable and wire insulation. Magic Chemical Co.

17—STEAM GENERATORS, small size, ready to install

Model TP Steam Generators are "pocket size" automatic package boiler units in the low price range, available in seven sizes from 15 to 60 hp (15 to 200 lb working pressure), for firing with light oil or gas or combination of these fuels. The units are designed to meet the need for an economical, automatic source of steam or hot water for small plants requiring the smaller capacities. Their small size — one model is 71 in. long, 35 in. wide at base, and 54 in. high — facilitates installation in limited space and affords flexibility in that other units may be added later to meet increased capacity requirements. Model TPS is fully piped and wired, needs only to be connected to service lines and breeching or stack. These units provide flexibility for the user of steam, permitting later addition of units for capacity increase. Bulletin TP-1 describes them. Ames Iron Works.



18—MINIATURE TRANSFORMER is available in two types

The JCA-O is a new butyl-molded miniature current transformer featuring both window-type and bar-primary construction. It is designed for operating meters and instruments and can be used on either single-phase two-wire or polyphase circuits. It is rated at 600-v and is suitable for use on circuits of 600-v or below. The window-type unit is suggested for operation over a bar-primary conductor on circuits up to its rated voltage. Two current ratings are available — 200.5 and 400.5 amp.

The new device is designed to carry its rated current continuously with a 55 C ambient temperature without overheating. With a 30 C ambient tempera ture it will carry 200 per cent rated current without exceeding the allowable 55 C rise, company engineers point out. According to them, the molded butyl serves as insulation and support and casing. It provides high dielectric strength, heat dissipating properties and resiliency and resists oxidation, arc-tracking and moisture.

The JCA-O can be mounted in almost any position, indoors or outdoors, and is declared especially suitable for use in small boxes. Both models can be equipped with an auxiliary mounting plate. General Electric Co.

19—SOLENOID VALVES for standby control, cycling

These diaphragm operated solenoid valves are designed for stand-by control of fluid flow and for automatic cycling operations on air compressors, boiler feed pumps, steam generators, motor generator sets, and oil burning furnaces. They are available in six pipe sizes from ⅜ to 1½ in. For the control of air, water, oil, various refrigerants and fuel gases, and sulfur dioxide gas, these valves operate on line pressures as high as 150 psi and as low as ½ in. of water. From 40 to 60 cycles per minute is given as their ideal cycling range.

The valves are supplied with aluminum bodies for gas and air service and with brass bodies for oil and water use. Seats and armature pilot plungers are stainless steel. Operating advantages announced for the valves are low power consumption, simplicity of construction (only moving parts are solenoid plunger and diaphragm), noiseless operation, coil interchangeability, high operating efficiency, wide choice of control, maximum shut-off safety and ease of maintenance. Eclipse Fuel Engineering Co.

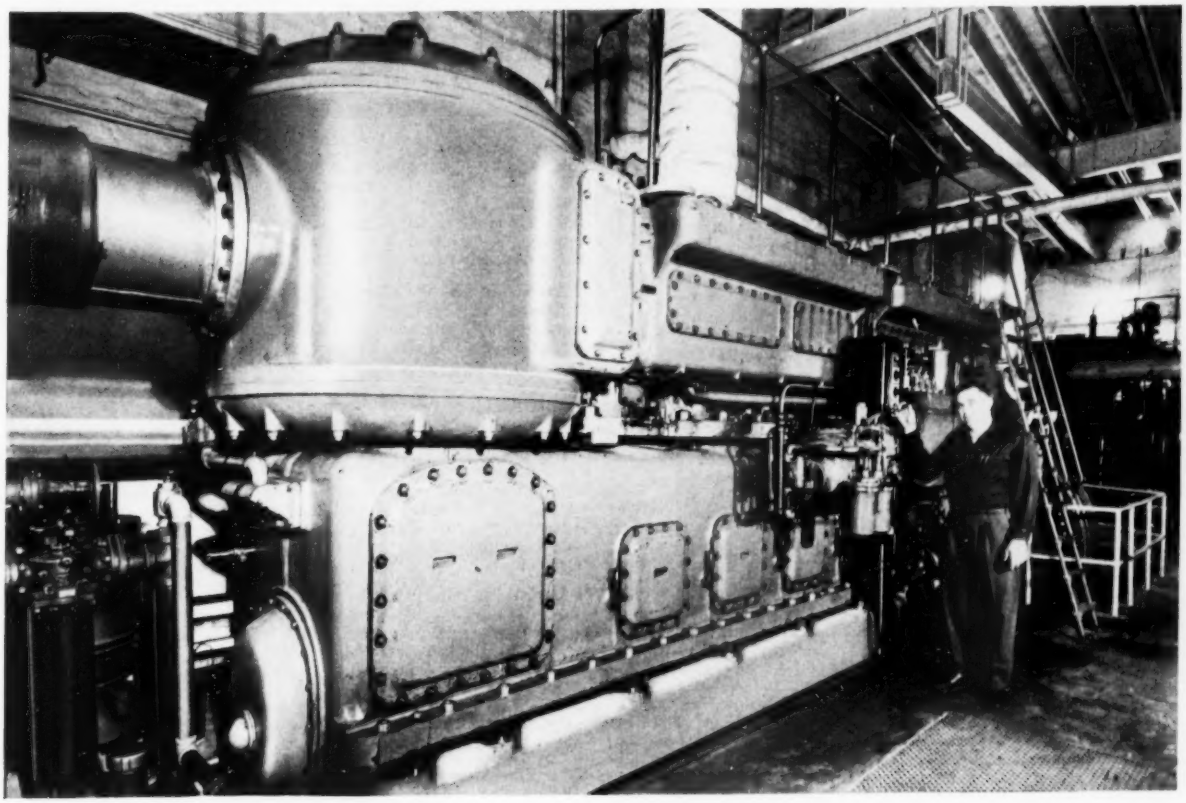
20—FOUR-WAY VALVE is hand-foot operated; for heavy duty

A hand-and-foot operated four-way valve with built-in, full-capacity, flow-control meters of the Venturi type is announced. An air and low-pressure hydraulic valve, it is designed to control double acting air or hydraulic cylinders. It is built for heavy-duty service, and features one balanced spool using renewable "O" ring type of packing. The flow control meters are designed to permit full-line volume without loss of pressure, and manufacturer says line-pressure variation will not affect valve function. The valve is available for remote pilot operation, cam, single or double solenoid together with time-delay features in four standard sizes, ¼ to ¾ in., for air, oil or water, pressure range 0 to 150 lb. Airmatic Valve, Inc.

21—INSULATION TAPE for application on cold lines

Den-Ite No. 8525 Cork Insulation Tape is offered as an insulating material for cold lines in air conditioning systems, freezers, commercial refrigerators, plumbing installations and wherever condensation is a problem. It is also said to provide an effective sound deadening barrier and is reported successful as a gasketing material. Manufacturer says it has excellent adhesion to itself and to all types of surfaces. Samples and literature are available. No supplemental adhesives are required. Dennis Chemical Co.

"Our tests show Gascon® Oils best!"



. . . says A.E. Harms, CHIEF ENGINEER

YUKON MILL AND GRAIN COMPANY, YUKON, OKLAHOMA

It's *doubly* important that the Yukon Mill and Grain Company's 5 diesels operate with as little trouble as possible. For this plant not only supplies power for the mill, but also for the City of Yukon.

Chief Engineer Harms writes, "When we changed to Sinclair GASCON Oil D-HD, the results were extremely satisfying – wear has been greatly reduced, varnish is gone from pistons and cylinders and stuck rings are a thing of the past. As you might expect, we now use Sinclair exclusively."

You too, can rely on Sinclair's full line of top quality diesel lubricants. Phone your local Sinclair representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save wear and replacements

For more data circle 532 on Post Card

CONSTRUCTION NEWS

Pine Bluff, Ark. — Arkansas Power & Light Co., has authorized a sale of bonds to total $7,500,000, of which approximately $2,500,000 will be used for expansion and improvements in generating facilities, power substations, transmission lines and other operating structures.

Los Angeles, Calif. — Southern California Edison Co., 601 West Fifth St., is planning an expenditure in current year of about $70,000,000, majority of fund to be used for expansion in steam-electric generating stations at Redondo Beach and El Segundo, each to total 156,000-kw., with installation of turbine-generators, high-pressure boilers and auxiliary equipment.

Torrence, Calif. — Bethlehem Pacific Coast Steel Corp., 20th and Illinois Sts., San Francisco, Calif., plans steam power house at proposed new steel fabricating plant at Torrence, near Los Angeles. It will comprise a number of one-story production units, equipped for large capacity. Cost reported close to $4,500,000. Proposed to carry out work soon.

Canon City, Colo. — Southern Colorado Power Co., Pueblo, has plans under way for new steam-electric generating plant at Canon City, estimated to cost about $3,500,000. Details of installation will be determined soon and work placed in progress.

Tampa, Fla. — Dixie Lilly Milling Co., 110 South Nebraska Ave., corn meal and other milled corn products, plans steam power house at proposed new wheat flour mill on site now being selected. It will comprise a main multi-story mill and several smaller structures. Cost reported over $1,200,000. It is understood that work will begin this fall. Cecil Webb is head.

Danville, Ill. — Tecumseh Products Co., Tecumseh, Mich., refrigeration condensing units, compressors and kindred equipment, plans boiler house at proposed new plant at Danville, where large tract of land has been selected. Entire project is reported to cost close to $1,500,000. Work will be carried out soon.

Glenview, Ill. — Signode Steel Strapping Co., 2600 Northwestern Ave., Chicago, Ill., steel bands, strapping, etc., is said to be planning steam power house as new plant on Lake St., Glenview. Main works will consist of several units and is reported to cost about $6,000,000. Skidmore, Owings & Merrill, 100 West Monroe St., Chicago, are architects.

Winslow, Me. — Hollingsworth & Whitney Co., 60 Batterymarch St., Boston, Mass., manila, food packaging and other papers, has had plans prepared by Fay, Spofford & Thorndike, 11 Beacon St., Boston, consulting engineers, for expansion and improvements in power plant at mill at Winslow, previously referred to in these columns. Work will include new 7500-kw. turbine-generator, 225-ft. stack, high-pressure boiler, feedwater treatment plant, new switchgear and auxiliary equipment. Work will be carried out in connection with mill extensions, entire project to cost over $7,000,000.

Everett, Mass. — Boston Edison Co., 39 Boylston St., Boston, Mass., has plans maturing for expansion in steam-electric power plant at Everett, previously noted in these columns. Work will include installation of a new 125,000 kw. turbine-generator, high-pressure boiler and auxiliary equipment. Cost reported over $5,000,000. Jackson & Moreland, Park Square Bldg., Boston, are consulting engineers.

South Bend, Ind. — Indiana & Michigan Electric Co. is arranging for sale of a block of common stock, to total about $2,000,000, proceeds to be used for expansion and improvements in plants and system, including generating facilities, power substations, transmission lines, etc.

Boston, Mass. — Commonwealth of Massachusetts, Department of Education, 200 Newbury St., plans extensions and improvements in boiler plant at local institution, with installation of additional equipment. Cost reported close to $120,000. Charles T. Main, Inc., 80 Federal St., Boston, is consulting engineer.

Pittsburgh, Pa. — Duquesne Light Co., 435 Sixth Ave., has disposed of a bond issue of $16,000,000, proceeds to be used in connection with 1954 construction program, including expansion and improvements in generating stations, power substations, transmission lines and other operating facilities.

Omaha, Neb. — Central Fibre Products Co., Inc., 15th and Leavenworth Sts., fibre products and paperboard specialties, plans boiler house at new one-story plant on local site at 10th and Missouri Sts. It will comprise about 240,000 sq. ft. floor space, and is reported to cost close to $1,000,000. Work is scheduled to begin soon. Nance & Rossie, Omaha Loan & Building Association Bldg., Omaha, are engineers.

Grenada, Miss. — McQuay & Co., Inc., 1600 N.E., Broadway, Minneapolis, Minn., unit heaters, air conditioners, etc., plans steam power house at proposed new branch plant at Grenada, to be erected by Grenada County Bd. of Supervisors and occupied under long-term lease. It will comprise a large main building and several smaller units, equipped for heavy output. Cost reported about $1,500,000.

Portland, Ore. — Pacific Power & Light Co., Public Service Bldg., has authorized a 1954-55 construction program to cost about $25,000,000, including generating stations, power substations, transmission lines and other operating facilities.

Philadelphia, Pa. — Crown Can Co., H and Erie Aves., tin cans and other metal containers, plans boiler house at new local plant on Ashton Rd., near Philadelphia Airport, to be used primarily for lithographing of metal for cans. It will total about 200,000 sq. ft. floor space and is reported to cost close to $4,500,000, with machinery and facilities. Proposed to carry out project soon.

Freeport, Tex. — Texas Co., 720 San Jacinto St., Houston, Tex., refined petroleum products, plans power plant at new oil refinery at Freeport. Program will consist of a series of steel frame structures for different divisions of operation. Plant will have a charging capacity of 10,000 bbl. per day. Entire project will represent a reported investment of about $16,000,000. Main offices of company are at 135 East 42nd St., New York, N. Y.

Pasco, Wash. — Columbia River Chemicals, Inc., recently organized, care of Fluor Corp., Ltd., 2500 Atlantic Ave., Los Angeles, Calif., engineer-contractor, plans steam power plant at new plant near Pasco, for production of anhydrous ammonia, urea, ammonium sulfate and kindred products. It will comprise a number of one- and multi-story structures, equipped for an initial output of 160 tons of anhydrous ammonia per day. Cost reported over $10,000,000. Engineer noted is in charge of project.

St. Louis, Mo. — Gulf Oil Co., 1120 Locust St., refined petroleum products, plans boiler plant at proposed new bulk oil terminal on Mississippi River waterfront in suburban district, where tract of 8 acres of land has been acquired. Entire project is reported to cost about $1,000,000, including pumping station, steel pressure tanks, etc. Main offices are in Gulf Bldg., Pittsburgh, Pa.

Mendota, Wis. — State Department of Public Welfare, State Capitol, Madison, Wis., has completed plans for new steam-electric power plant at institution at Mendota. Installation will include turbine-generator unit, high-pressure boilers, coal and ash handling equipment, feedwater heater unit, switch-gear, etc. No estimate of cost announced. Work will begin soon. Battey & Childs, 231 South LaSalle St., Chicago, Ill., are consulting engineers. George M. Keith is acting director of Department noted.

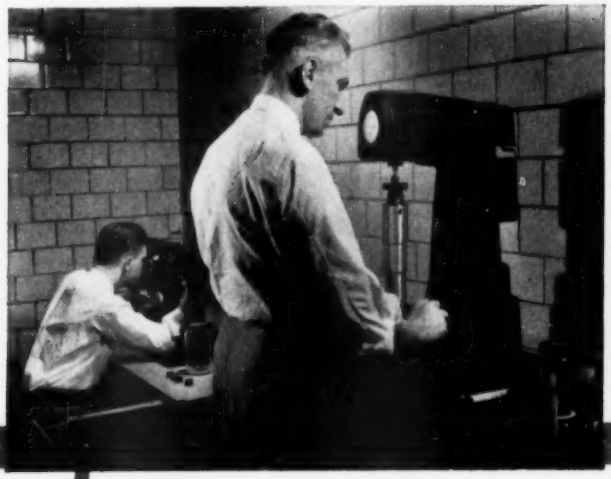
Las Vegas, Nev. — Work is scheduled to begin in November on proposed new steam-electric generating station of Southern Nevada Power Co., South Second St., recently noted in these columns, with completion by close of 1955. New plant will have a rated output of 44,000-kw., and is reported to cost about $5,500,000, instead of smaller amount mentioned previously. Work will include extensions in power substations, transmission lines and other operating facilities.

Carlsbad, N. M. — National Farmers Union, 1555 Sherman St., Denver, Colo., fertilizers, etc., plans steam power house at proposed new potash plant at Carlsbad. Project will comprise several large units, equipped for heavy output, and is reported to cost over $10,000,000. It is understood that work will begin this fall.

Syracuse, N. Y. — Niagara Mohawk Power Corp., 300 Erie Blvd. West, has work under way on two new hydroelectric generating stations on Raquette River, Adirondack Mountains, scheduled for completion in 1955, and will begin construction of two additional such plants on same river in near future, to be completed in 1956 and 1957, respectively. With plant at South Colton, N. Y., recently placed in service, this will make a series of five new generating stations with gross rating of 100,000 kw. Entire project is estimated to cost about $28,000,000, including power substations, transmission lines, etc.

Cleveland, Ohio — Cleveland Electric Illuminating Co., Public Square, has plans for installation of a new coal-processing and mechanical-handling system at Eastlake generating station, including heater, pulverizing units, dryer, air and water pollution control equipment and accessory apparatus. Cost reported close to $2,000,000. Work is scheduled to be carried out soon.

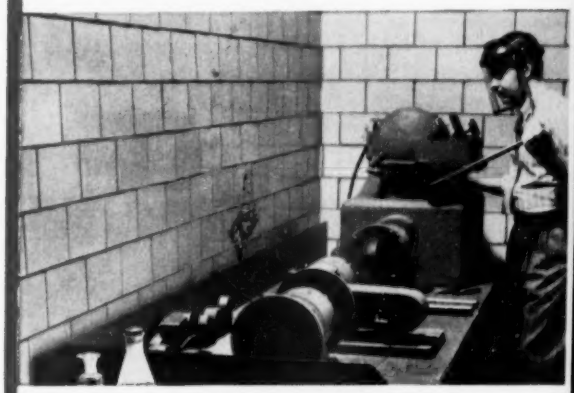
◀ Heat-treating and physical testing equipment shown at left is used for quality control of welding operators and for development of new welding procedures.



▲ This Rockwell hardness testing machine measures the hardness of weld specimens as a guide to proper procedures for heat-treating of welds.

Daily rigid testing is your insurance of quality welds in

NAVCO FABRICATED PIPING



▲ A laboratory technician cuts a sample from a pipe weld prior to grinding and polishing for metallographic examination.

At Navco, a continuous parade of weld specimens are processed in the new, modern physical-chemical testing laboratory. It is here that weldments are studied metallographically and tested physically—all on a rigid schedule of quality control practices. Navco customers have benefited from progressive quality control practices for more than 40 years; they have come to know that piping installations, engineered, fabricated and erected by Navco, are precise, accurate and dependable.

Call on NAVCO for your next piping job.

▲ Here a weld specimen is etched to outline the grain structure for further metallographic study.

NATIONAL VALVE & MANUFACTURING COMPANY

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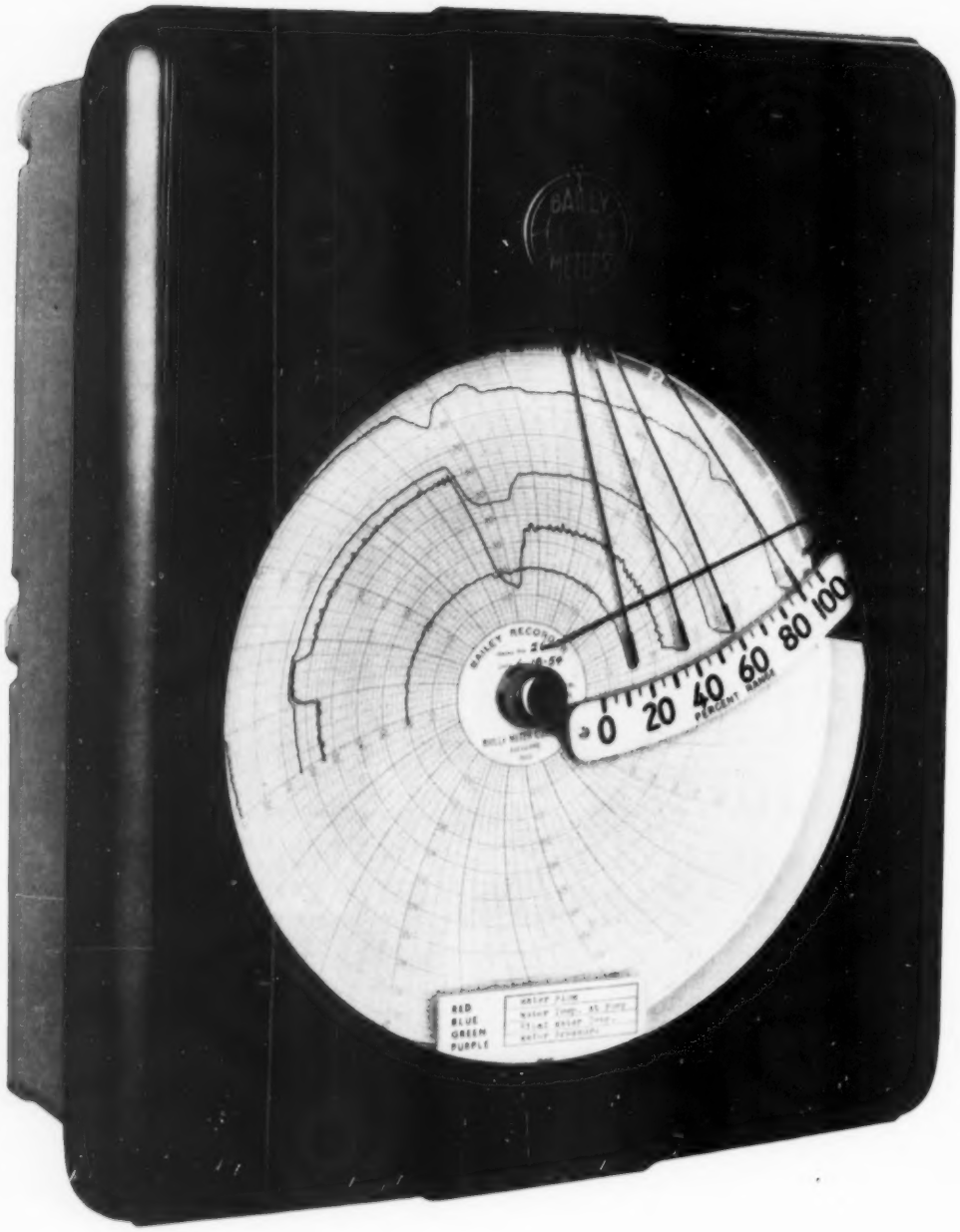
Announcing the New Bailey

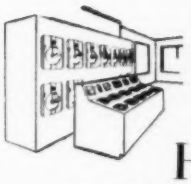


The New Bailey Recorder provides continuous chart records of any four measured variables:

% combustibles	density	flow	pH	ratio	speed
combustion	differential	liquid level	position	smoke density	temperature
conductivity	draft	% oxygen	pressure	specific gravity	vacuum

Recorder for—

Pneumatic and Electric Transmission Systems



Here is a panel-mounted recorder that offers new versatility never before available in a single instrument. Its unique interchangeable-unit design permits recording up to four measured variables, regardless of their nature or the location at which they are measured.

Individual plug-in type pneumatic or electronic receivers—and corresponding integrators—are interchangeable in the four identical frame-slots, permitting any combination of four pneumatic or electronic signal receivers, *or any two receivers and their two integrators.*

For the first time you can record four telemetered measurements on a single 12-inch circular chart—with a minimum of first cost and installation expense, and a maximum of operating economy. Low cost multi-purpose components permit fast and easy adaptation to new or changed process cycles.

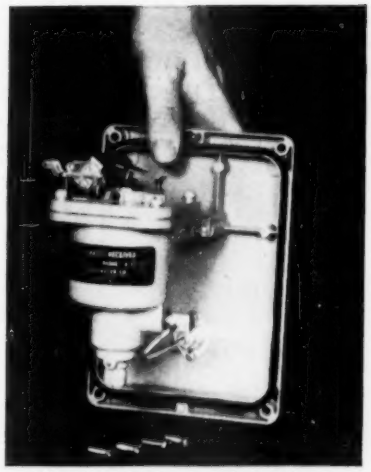
Check These Outstanding Advantages

Extreme Flexibility of Application is provided through the use of pre-calibrated plug-in type units—pneumatic or electronic—to record any measurable variables, in any combination. For example, you can "plug-in" pneumatic receivers along with electronic receivers to record up to a total of four variables on the same chart. Or your recorder casing can accommodate two integrators and their two corresponding recording receivers for rate of flow.

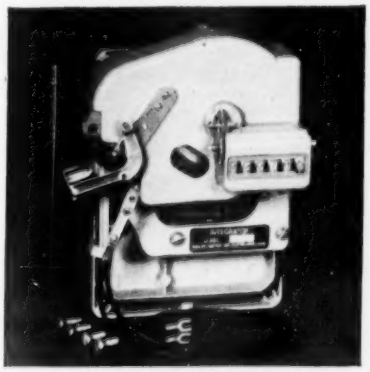
Faster, Easier Servicing of instruments is possible because of the new, sealed ink sacs and capillary pens. Under normal conditions ink sacs need be replaced only once each year. There is no day-to-day inking of pens.

Faster, Easier Ordering from Stock results from the unique standardized unit design. You can select any combination of recording receivers to fit your needs, by reference to simplified catalog specifications, and receive shipment without the delays ordinarily resulting from custom assembly. Complete interchangeability of plug-in type components simplifies stocking of spare units.

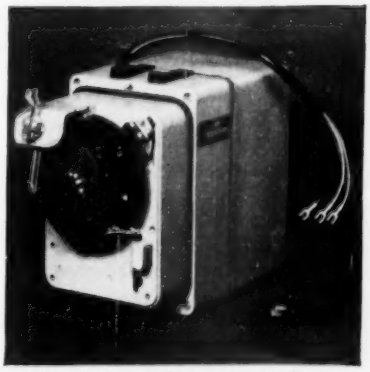
G34-2



Plug-in type pneumatic receiver



Plug-in type integrator



Plug-in type electronic receiver

Write for complete specifications—use handy coupon below

BAILEY
METER COMPANY
1040 IVANHOE ROAD
CLEVELAND 10, OHIO
Controls for Power and Process

BAILEY METERS

COMBUSTION
TEMPERATURE
PRESSURE
GAS ANALYSIS
LEVEL
RATIO
FLOW

Bailey Meter Company
1040 Ivanhoe Rd., Cleveland 10, Ohio

Please send me product specifications on the new Bailey Recorder, as follows:

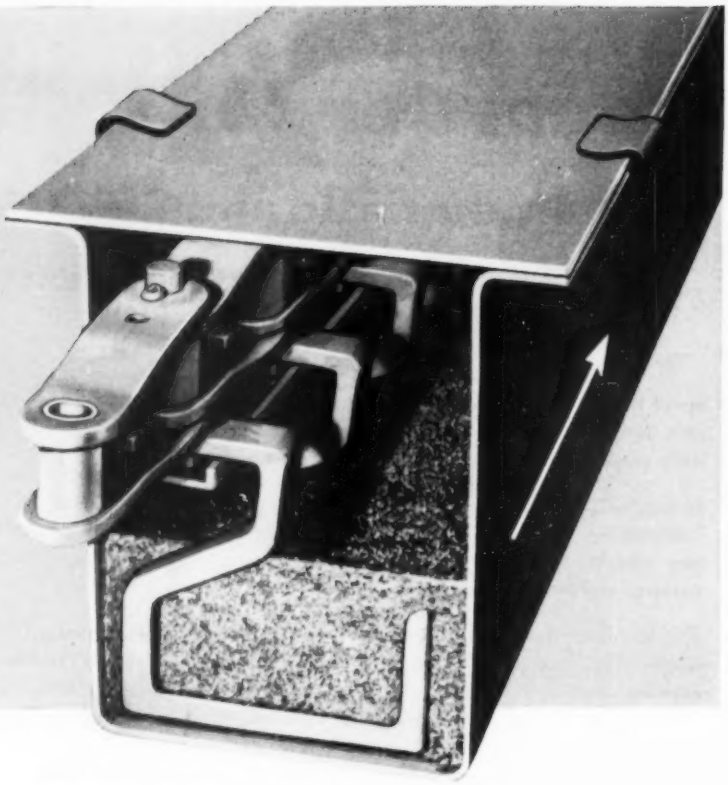
☐ With Pneumatic Receivers—Spec. P11-5
☐ With Electronic and Pneumatic Receivers —Spec. E12-5

Name_____
Title_____
Company_____
Street and Number_____
City_____ Zone_____ State_____

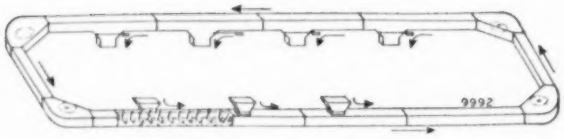
For more data circle 534 on Post Card

CONVEYS ANYTHING Economically from COAL to CORNSTARCH

with simultaneous pick-up or discharge at one or many points . . . without dust or contamination . . . in small space



This is an S-A REDLER Horizontal Closed Circuit Conveyor — and a very remarkable unit it is!



It conveys in four directions — can pick up and discharge at many points on its run simultaneously or selectively—does the work of several conveyors of other types. It is fully enclosed — dust-tight and contamination-proof. Because it moves materials *in mass*, in a solid column, it minimizes dust formation and degradation and practically eliminates explosion hazards.

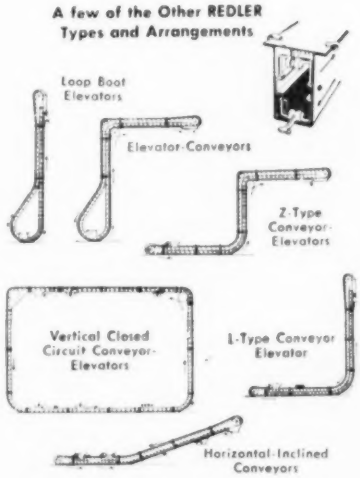
It is self-feeding and can be choke fed without jamming. Any excess material simply recirculates until needed. The REDLER is also self-cleaning, an important advantage when the operation calls for running various materials in sequence. It makes an ideal blending conveyor.

Unusually compact, REDLERS require a minimum of structural support. They can be easily and economically adapted to practically any plant layout.

The closed circuit REDLER is just one of many types furnished by S-A. If you handle or work with any kind of granular, pulverized, flaky or small lump material, a REDLER can help you do it better, cleaner and at lower cost.

Write for Catalog No. 140. We'll be glad to give you a preliminary cost estimate. No obligation, of course.

A few of the Other REDLER Types and Arrangements



SINCE 1901 S-A STEPHENS-ADAMSON MFG. CO.

STEPHENS-ADAMSON MFG. CO.

86 Ridgeway Avenue, Aurora, Illinois • Los Angeles, Calif. • Belleville, Ontario

Engineering Division

Specialists in the design and manufacture of all types of bulk materials conveying systems.

Standard Products Division

A complete line of conveyor accessories including centrifugal loaders—car pullers—bin level controls—etc.

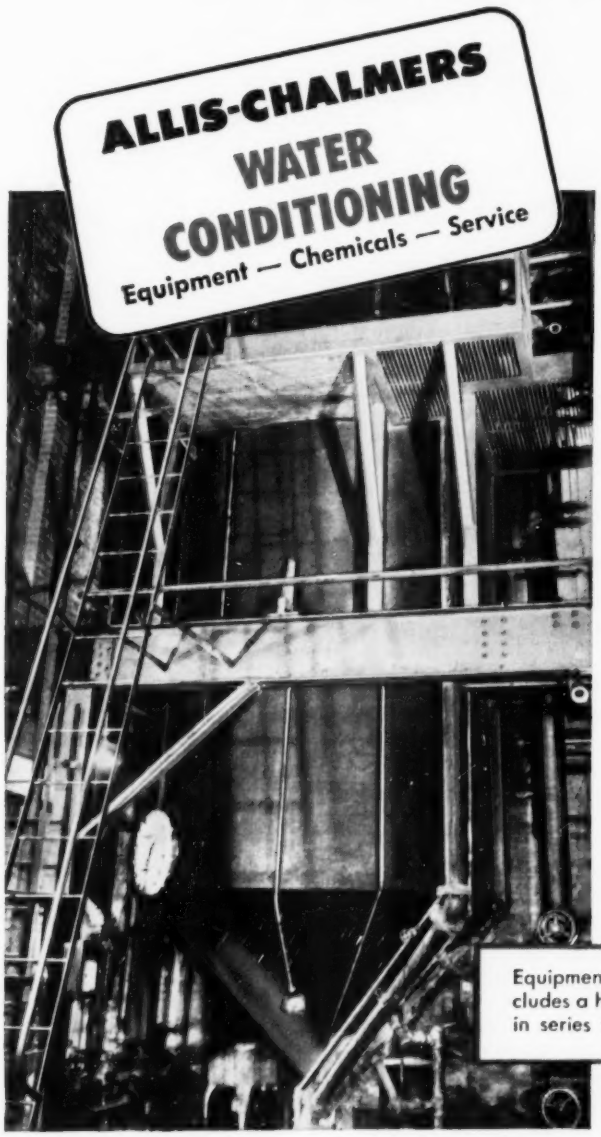
Sealmaster Division

A complete line of industrial ball bearing units available in both standard and special housings

For more data circle 535 on Post Card

Minneapolis Gas Co., Minneapolis, Minn., Gets...

MORE BOILER FEEDWATER



How to increase feedwater supply without adding excessively to chemical and equipment costs? That was the problem at Minneapolis Gas Company, Minneapolis, Minn., when installation of new equipment increased demands on the power plant.

Allis-Chalmers water conditioning engineers solved this problem with a hot lime, ion exchange system that provides zero hardness, extremely low silica content, low alkalinity and low CO_2 in steam. Chemical costs are very reasonable, since only salt and lime are needed. An added dividend can come from the small amount of space required for equipment — for example, in one installation of this type, the resin tanks are tucked under the basement stairs.

Solve Any Water Problem

You can find a solution to any water conditioning problem by consulting with an Allis-Chalmers water conditioning expert. Allis-Chalmers will provide analysis and a complete recommendation, in addition to supplying you with the chemicals and equipment you need.

If you would like to learn more about the hot lime, ion exchange process outlined above, get a copy of Allis-Chalmers Water Conditioning Informational Bulletin 49 from your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4403

Equipment similar to this at Minneapolis Gas Co. includes a hot process lime-soda softener which is placed in series with the hot zeolite (ion exchange) unit.

ALLIS-CHALMERS

For more data circle 536 on Post Card

Carrying coal in Delaware Valley with U.S. Rubber Conveyor Belts

(at right) U. S. Giant® Conveyor Belt, carrying coal from car dumper to breaker house.

Panoramic view of part of conveyor belt system utilizing U. S. Giant Conveyor Belting in power plant on the Delaware River.

To feed the four boilers in this power plant in the Delaware Valley, United States Rubber Company conveyor belts, capable of handling 300 tons of coal an hour, take the coal from hopper cars to breaker house to coal bunkers. Like so many other successful belting installations, this one is the result of United States Rubber Company's "Three-Way Engineering" — in which "U.S." engineers work with the engineers of the conveyor system and the power company engineers to turn out the most durable, economical belt system for the specific job. In America and abroad there are thousands of "Three-Way Engineered" jobs, some large, some small — but all steadily keeping output high, costs low. Get in touch with any of the 27 "U.S." District Sales Offices, or write address below.

"U.S." Research perfects it... "U.S." Production builds it... U.S. Industry depends on it

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

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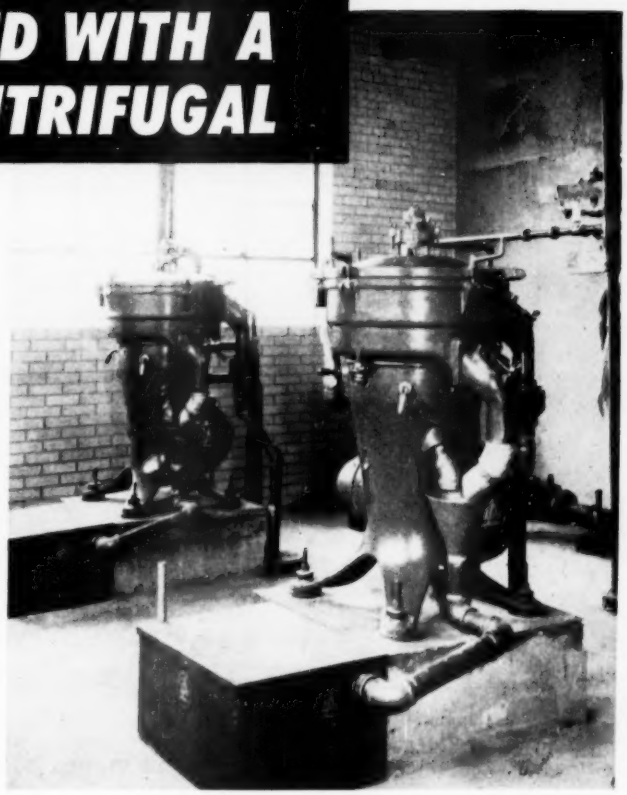
TO CUT FUEL COSTS..... BURN RESIDUALS, PURIFIED WITH A DE LAVAL CENTRIFUGAL



Many diesel-powered plants, ashore and afloat, are successfully burning heavy fuels with resulting large economies*.

They are purifying the residuals with De Laval Oil Purifiers—the most effective means ever devised for the purpose, as proved by efficiency comparison tests.

De Laval Oil Purifiers remove a *maximum* amount of incombustible solids—and do it at constant operating efficiency.

It will pay you to investigate the profit possibilities of burning a less costly fuel, purifying it the *De Laval* way. Write for complete information.

FOR EXAMPLE...

The Keystone Heights, Florida, plant of the Clay Electric Co-op burns straight residual fuels ranging in viscosity from 110 to 166 Furol at 122° F. and in API gravity from 13.5 to 9.4, running them through a De Laval Purifier. The savings, says the Chief Engineer, amount to as much as *$4,500 per month*.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York ● 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5

DE LAVAL

HEAVY OIL PURIFIERS

For more data circle 538 on Post Card

Some men search for years among fine tobaccos before they find a blend that's just right. When they do find it, pleasure proves . . .

THERE'S ENOUGH DIFFERENCE TO MAKE ALL THE DIFFERENCE

It's the same way with many products you buy for service, notably Heat Exchanger Tubes. Specifications for alloys and applications are well recognized. And yet it is true that many Scovill customers find enough difference in the performance of our Heat Exchanger Tubes to make *all* the difference in the efficiency and economy of their installations.

Part of it is due to Scovill production differences, such as Continuous Casting, and our century and a half of metal-producing "know-how." Part of it is due to Scovill's unrivaled Technical Application Services. Almost always it adds up to longer tube service, less trouble maintaining efficiency under tough operating conditions, worthwhile savings. Let us prove it. Scovill Manufacturing Company, 99 Mill Street, Waterbury 20, Conn. Phone Waterbury 4-1171.

SCOVILL
HEAT EXCHANGER TUBE

Phosphorized Admiralty ★ Admiralty ★ Arsenical Admiralty ★ Muntz Metal ★ Naval Brass ★ Red Brass, 85% ★ Deoxidized Copper Arsenical Copper ★ Copper Nickel, 10% & 20% ★ Cupro Nickel, 30% ★ Aluminum Brass ★ Aluminum Bronze, 5% ★ Duplex Tube BBCS4

For more data circle 539 on Post Card

Ultra-Modern Design

Administration and Research Center
S. C. Johnson & Son, Inc., Racine, Wis.
Architect: Frank Lloyd Wright
Consulting Mechanical Engineers:
Samuel R. Lewis & Associates

...fired by **coal**

In the famous plant of Johnson's Wax, modern equipment makes coal a clean and automatic fuel . . . and saves dollars year after year.

Says: Adrian Wilson, Power Plant Assistant Manager
S. C. Johnson & Son, Inc.
Racine, Wisconsin

"Our plant uses an average of 900 tons of coal per month. At the conclusion of a recent analysis of relative fuel costs, we were unable to justify a change from coal to any other fuel. In burning coal the modern way, we have steadily improved the efficiency of our power plant."

•

If you plan to modernize—or to build a new plant, be sure to investigate the convenience and money-saving advantages of coal when burned with modern equipment.

You can enjoy automatic operation and save on labor by installing up-to-date coal-feeding and ash-handling systems. And you can eliminate dust or smoke nuisances with such devices as dust collectors and cinder rejectors. Often such equipment can pay for itself in fuel and labor savings in only a few short years.

Get the advice of a consulting engineer. He can make a fuel analysis for you. He can advise you on what equipment can best fill your specific needs and return you a big saving year after year with coal.

YOUR BEST BUY IS BITUMINOUS

- **Today's lowest-cost fuel,** in most places, is Bituminous Coal!
- **The most stable fuel in price is coal,** because coal reserves are virtually inexhaustible . . . coal mining is highly mechanized.
- **The safest fuel to store and use** is coal.
- **Your best bet for saving dollars is coal** . . . for modern equipment greatly multiplies coal's inherent advantages.

Additional case histories, showing how other types of plants have modernized and saved money by burning coal with modern equipment, are available upon request.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

For more data circle 540 on Post Card

Service . . . where and when you want it

PROMPT, experienced service is one of the most important plus values you get when you buy Honeywell instruments. An unequalled organization of trained specialists is always at your call at more than 110 offices in the United States and Canada. Offices are located in practically every large industrial city of the country . . . close to every major production center.

Trained Personnel

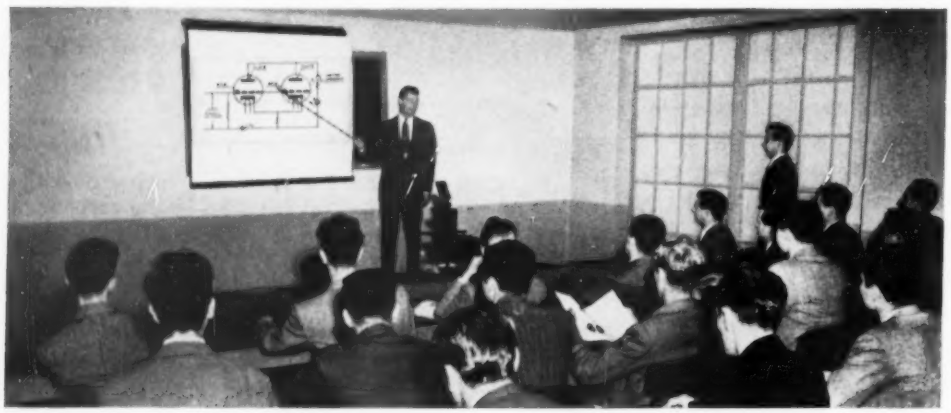
Honeywell service men are schooled not only in the theory of measurement and control, but also in the practical art of keeping good instruments in the best condition. Hand picked men begin this instrument education in an intensive training program in Honeywell factories. After graduation, they serve an apprenticeship in the field offices . . . while they learn still more about instrument maintenance from first-hand contact with plant problems. By the time a Honeywell man arrives at your plant on a call, he's a finished product worthy of the responsibility he bears, and capable of doing the kind of service job that you need . . . and that your Honeywell instruments deserve.

When trouble strikes, a wire or telephone call will bring a service man to your plant . . . often within a few hours. This assurance of prompt action means a lot to your production schedules. You'll never be left out on a limb because of delays in instrument maintenance.

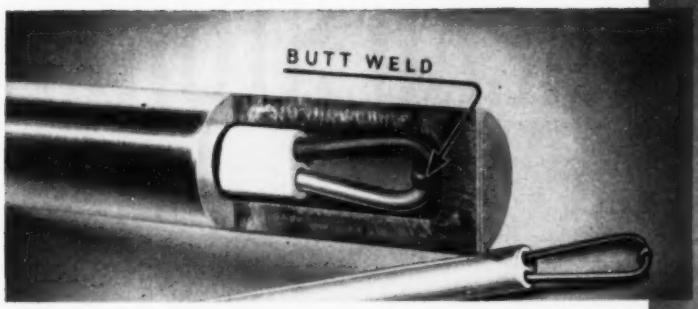
Periodic Service Plan

But why wait for emergencies? Preventive medicine works on instruments, too. And the prescription is simple . . . a Periodic Service Contract, which brings a Honeywell service man to your plant at regular intervals to inspect, clean and adjust any Honeywell instruments you have. The plan is economical . . . can save you many hours of lost production time. Your nearest Honeywell office will be glad to give you full details.

A faster, stronger *for steam*



TRAINED TO SERVE: *In Honeywell's service school, students get a thorough grounding in instrument theory and practice. After graduation, they become part of the most extensive organization of its kind in the world . . . ready to serve you competently and promptly, whenever and wherever you need them.*



FOR getting high-speed, precise measurements of steam temperatures, the Brown butt-welded thermocouple is the ideal partner for *ElectroniK* instruments. This thermocouple's unique characteristics come from an entirely new kind of design, in which the two couple wires are electrically welded together in a butt joint.

The thermocouple is *faster*—because the mass of the junction is much smaller than the usual twisted joint. It's *stronger*—withstands vibration and shock better. And it's *more accurate*—because the loop formed at the joint prevents heat conduction from the junction back to the insulators.

A wide line of thermocouple wells is supplied for various steam plant applications . . . including a series especially designed for high pressure steam lines. All Brown thermocouple wells are precision-machined to highly uniform wall thickness, to guarantee dependability at high temperatures and pressures. They are available in a broad choice of standard sizes and designs, supplemented by special types made to individual specifications.

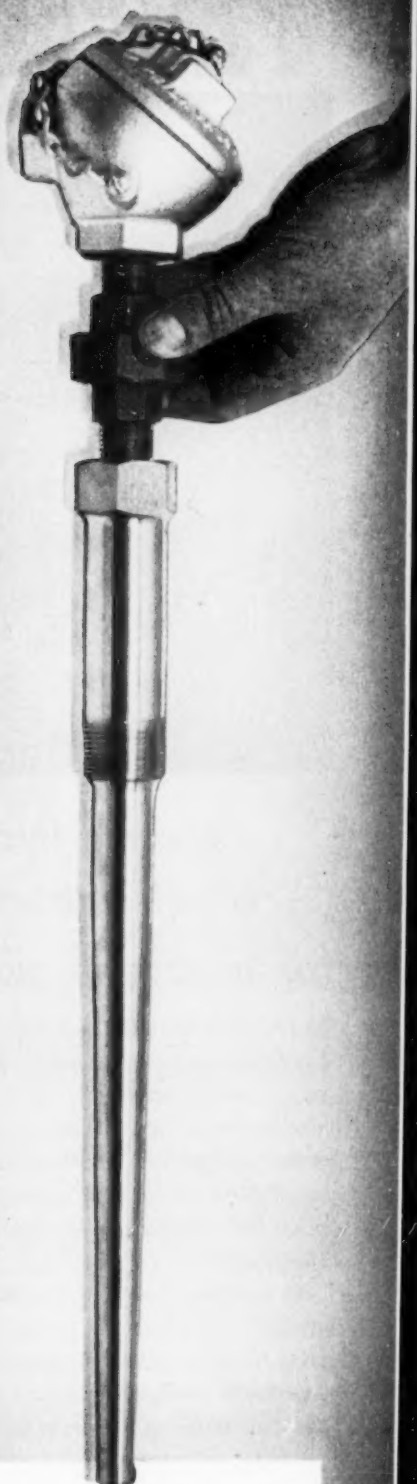
thermocouple *plant temperatures*

For specifying and purchasing all instrument supplies and accessories, you'll find new convenience and economy in the Honeywell Supplies Man—HSM—Plan. Your local HSM will be glad to explain the plan in detail, and to show you how planned buying can save you time and trouble. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4587 Wayne Ave., Philadelphia 44, Pa.

REFERENCE DATA: Write for Pyrometer Supplies Buyers' Guide No. 100-4 . . . and for Specification Sheet No. 200-2 on Thermocouple Wells.

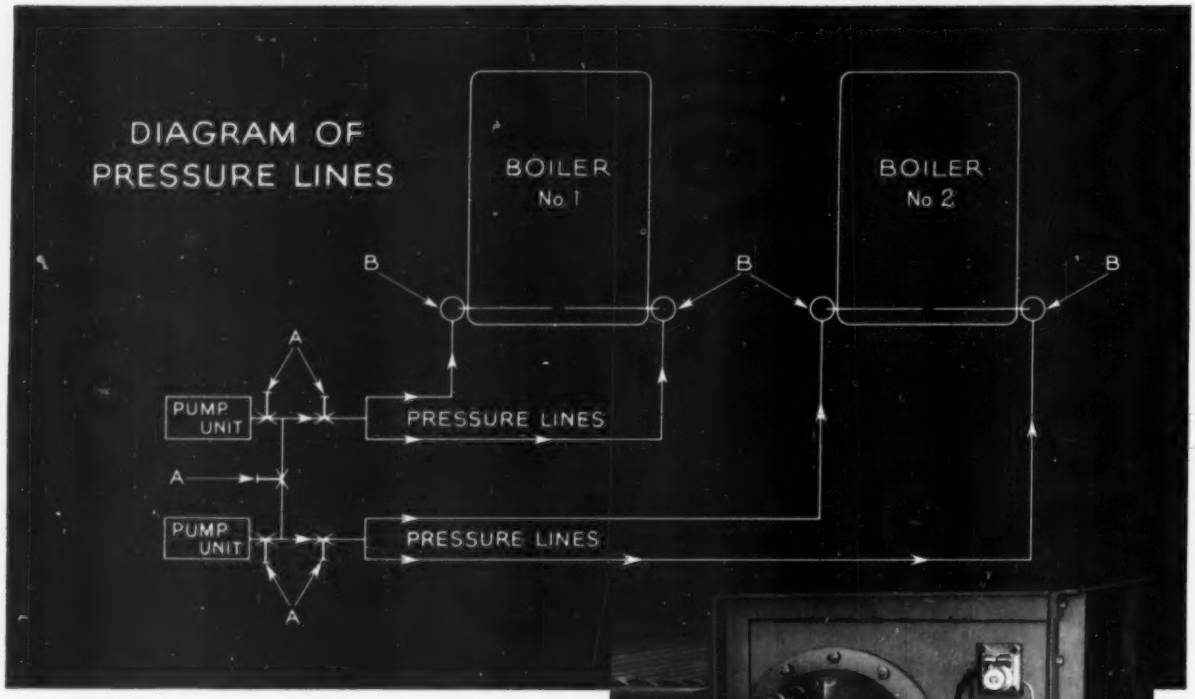
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

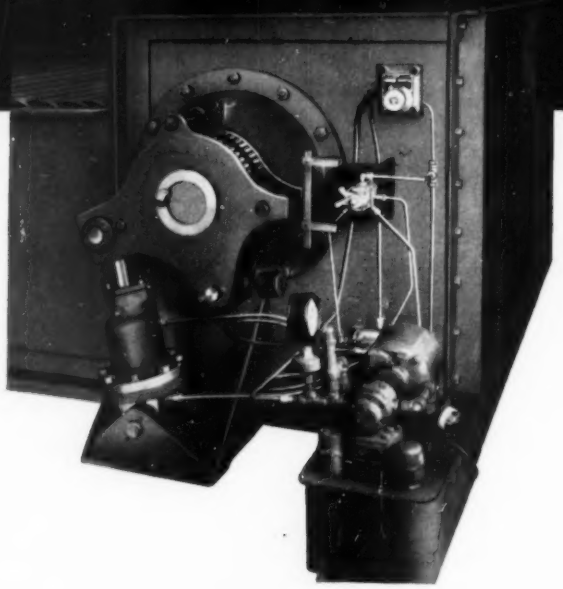


STEAM THERMOCOUPLE *has tapered stainless steel well, precision-drilled to highly uniform wall thickness. Inset shows butt-welded thermocouple junction. The small mass gives fast response . . . curved wires prevent heat conduction away to the insulators.*

For more data circle 541 on Post Card

PERFECT SPREAD STOKER





permits hydraulic
dual grate drive
for maximum dependability

ALL Continuous Ash Discharge Perfect Spread Stokers can be driven by a single power unit. The fluid power pump feeds cylinders "B" on both sides of the grate. This hydraulic system makes it easy to interconnect two stokers and provide for *dual drive* . . . assurance of uninterrupted service in an emergency as one pump will drive both grates by opening or closing valves "A" (See diagram).

In addition, the AE hydraulic drive assures smooth operation, requires less power and maintenance, and gives an infinite choice of speeds from zero to maximum. Automatic overload protection built in. Complicated and aisle-blocking reduction gears are eliminated. The pumping unit can be located next to the stoker or at any convenient place in boiler room or basement.

Write for full information about the AE Perfect Spread . . . the stoker that provides true, continuous feeding of 50 to 7500 lbs. of coal per hour per feeder and never clogs, *not even on wet coal.*

AMERICAN ENGINEERING
COMPANY
2408 ARAMINGO AVE., PHILADELPHIA 25, PA.
IN CANADA: AFFILIATED ENGINEERING CORPORATIONS, LTD., MONTREAL 2, CANADA
AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

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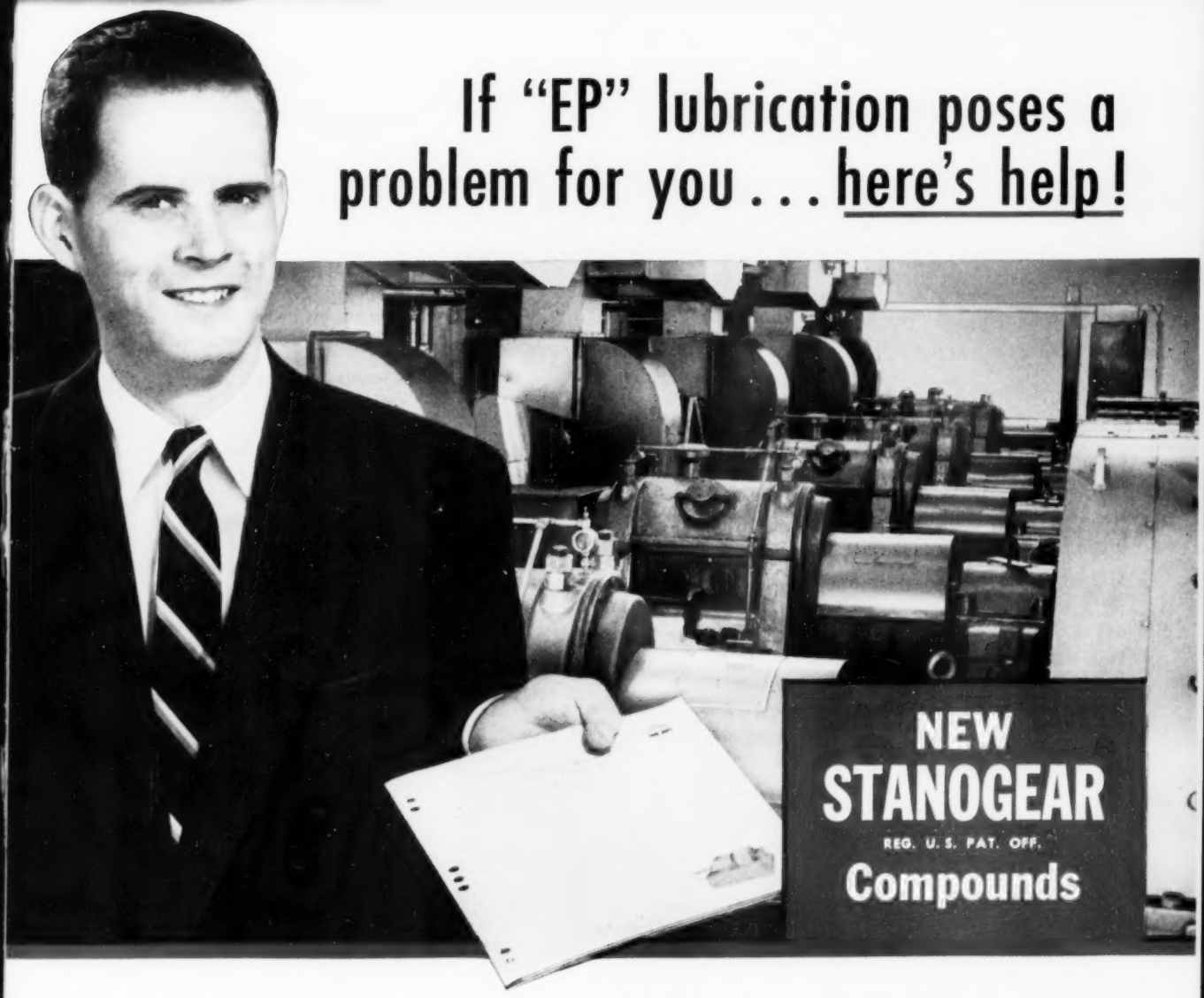
If "EP" lubrication poses a problem for you . . . here's help!



Here's new technical letter on Stanogear Compounds—send for free copy today!

If you've been having lubricating problems with overloaded or shock-loaded gears on your equipment, New STANOGEAR Compounds—with 7 better EP lubricating features—are made just for you. New and improved STANOGEAR Compounds are recommended for industrial gear applications where the operating conditions of the gear unit demand an extreme pressure lubricant . . . their superiority has been proved in test after test and *on the job!*

New STANOGEAR Compounds work seven ways better to solve your EP problems: **1.** higher load-carrying capacity **2.** superior retention of load-carrying capacity **3.** freedom from objectionable deposits **4.** excellent storage stability **5.** good water separation **6.** anti-foaming **7.** increased versatility

Now Standard Oil has prepared a special technical letter to give the complete story on STANOGEAR Compounds and EP lubrication. For your copy of this factual, informative bulletin, call your nearest Standard Oil office. The Standard Oil lubrication specialist there can answer your questions and send you a copy of the EP story, without obligation. Or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY STANDARD *(Indiana)*

For more data circle 543 on Post Card

which impulse for you?

STANDARD

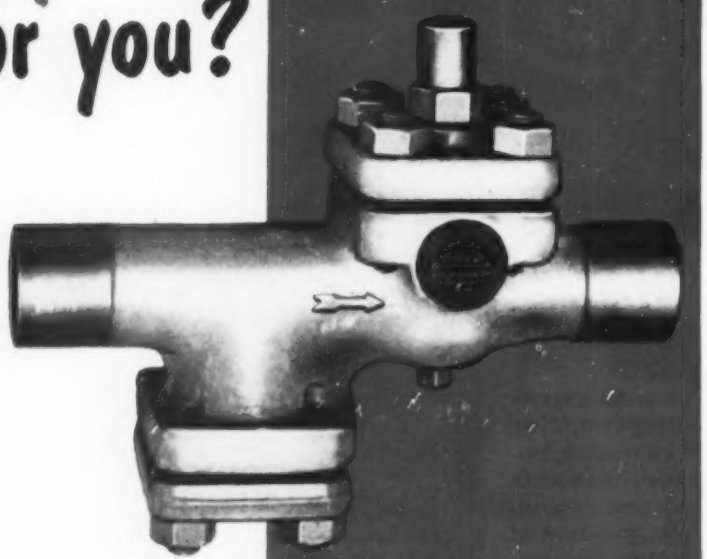
The standard YARWAY Impulse Steam Trap serves all normal trapping requirements. Factory set to operate without adjustment at all pressures from 20 psi to 400 psi (Series 60) and 600 psi (Series 120). For pressures below 20 psi, merely remove split washer.

Numerous advantages like:

small size
quick heating
steady temperatures
stainless steel construction
one moving part
non-freezing
low cost

More than 900,000 used throughout industry.

Write for YARWAY Bulletin T-1740.



HIGH PRESSURE, INTEGRAL STRAINER

YARWAY Integral Strainer High Pressure Impulse Steam Traps operate on some of the highest pressure steam lines in the country. Same operating principle as the standard YARWAY Impulse Trap. Strainer built into trap.

Ample capacity when system is being "warmed up"—yet will handle relatively small amounts of high temperature condensate without losing prime. Six sizes—½" to 2". Pressures to 1500 psi (flanged ends) or 2500 psi (welding ends).

Write for YARWAY Bulletin T-1740.

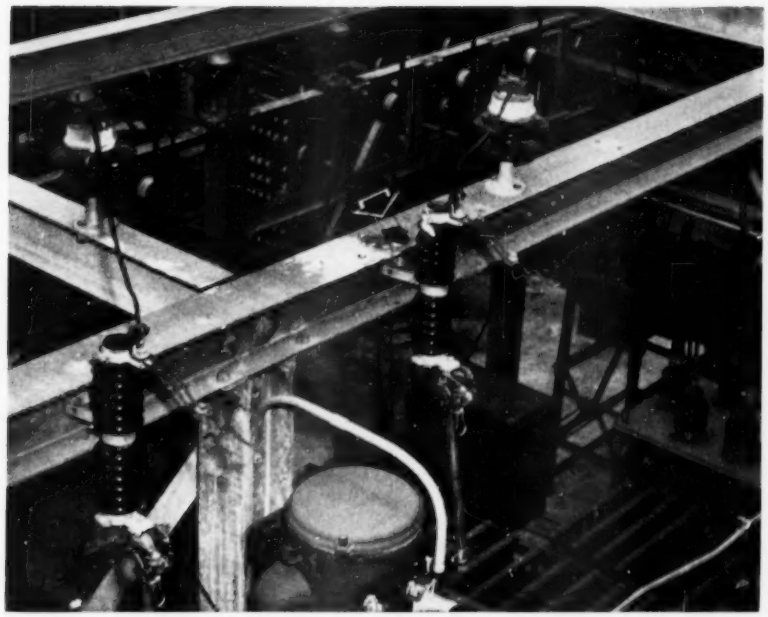
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY

impulse steam traps

YARWAY Impulse Steam Traps and Fine Screen Strainers are stocked and sold by more than 250 convenient local distributors. Write for name of one nearest you.

For more data circle 544 on Post Card



Arrow shows remains of the starling who tried to make a meal off a 13-kv line

Switching Station Gets the Bird . . . Plus Free Relay Testing

When a starling decided to be a ground fault in a 13-kv substation, it gave the protective system a drastic workout. Here the author, plant engineer in a large textile mill, describes what happened

WE HAVE a 13.8-kv switching station outside the power plant containing oil circuit breakers for the four unit substations at the main plant and the two lines that go to the other plants. The generator breaker for the 10,000-kva turbine is also in this yard, and we put a lot of thought on ground relay protection for the Y connected big generator and the various service and step-up transformers on the other turbines.

We had also made an honest effort to time out the relays at the other plants that take power from the 13.8 kv lines. We had to make our relay tests in a rather crude way, and we did it by running a cable from an a-c welding transformer through the window type current transformers, measuring the current from this transformer with a tong test ammeter, and timing, with a watch, how long it took the relays to operate. This gave us a test of relay wiring continuity and a fair idea of time. Where we did not have window type current transformers we connected from the welding transformer to the busses through the instrument transformer and built up test current this way.

At any rate, just recently, a starling lit on the steel work and happily hopped down the steel to just under a lead going to a 13.8-kv potential transformer with a fuse cutout mounted ahead of it. The clearance from this wire to the steel is fully ample as long as it is full of air, but when the air contains "vun dam pird" it isn't enough.

We had a phase to ground arc-over from the wire to the steel, this burnt the instrument lead in two and the arc went phase-to-phase on the other instrument transformer lead. At the time we had the 10,000, 3,500 and 3,000-kw turbines on at the main plant, the 1,500-kw on at the Finishing Plant and one of 1,000-kw at the Weaving Mill.

The ground relay operated to knock all the main turbines off the line and there went 16,500 kw of generator. The governors all held and not a single machine went out on overspeed. This dumped a load on the 1,000 and 1,500 that were still on the line and their line breakers cleared and the turbines held onto the inside-plant load at both locations. The relay targets at the Finishing and the Weaving Mill showed that both units went out on a phase-to-phase line short and the instantaneous targets came up. There was only one arc, damage was confined to vaporizing about 4 ft of ½-in. copper rod, and we could have started up immediately but waited until we could cut all the damaged conductor clear and take a look at the insulators around the flash, which were not damaged. The important part is that the relays that had been tested for sequence operated as they should, and the two small turbines held onto the inside-plant load, some of which involves processing that ruins a lot of goods if power fails.

Now you understand what we mean when we say our future switching station specifications will contain a clause saying that striking distance from live busses to grounded steel work shall be ample to include sufficient air and "vun dam pird." This clause will give only one trouble — the corpus delicti we found was a starling — and one should examine the kind of birds available to decrease striking distance before setting these distances in inches. Thus ornithology comes into switchgear design and we will probably be all right unless starlings get bigger or we get infested with pigeons.

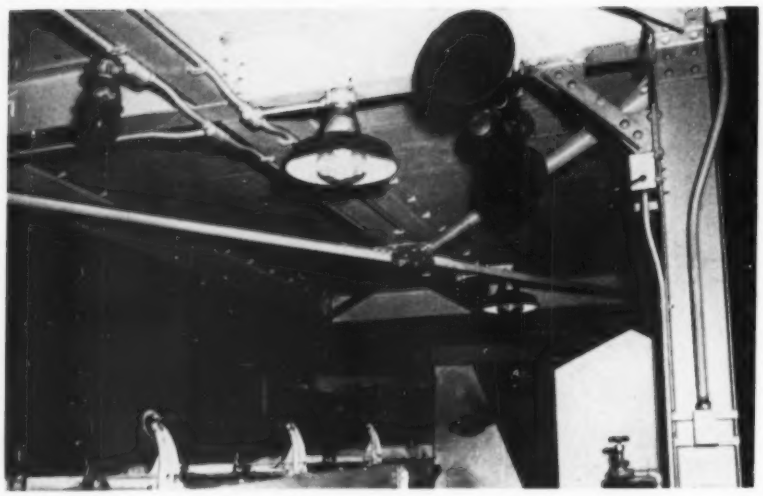


Fig. 1. Loudspeakers and handset near coal conveyor. In case of trouble it can be reported immediately and appropriate instructions for its remedy can be relayed with minimum loss of time

Why Power Plant Sound Systems?

Because they are non-restrictive. They require no codes, operators don't have to watch lights or annunciators. They provide direct communication. They save much time and money

By ARTHUR W. SCHNEIDER*

FOR MANY YEARS, power plants have made use of various types of communication systems such as Bell telephones, privately owned telephones, horns, and annunciators. Why, then, do we need sound systems, that is, communication systems consisting of microphones, amplifiers, and loudspeakers?

Development of Sound Systems

The basic reason is that such sound systems are non-restrictive in their over-all function. The person called does not have to be at a certain location, does not require a code, nor need he watch lights or annunciators. Previous to the development and use of sound systems, the person wanted would have to be called either on the telephone or by means of a coded signal, and the person calling would have to wait until he received an answer. This involved time delay on the part of both parties.

Thus, a need developed for a better communication system — one that was more direct in its action and one that could be tied into the economics of a plant operation. Owners of such systems have found that the use of a sound system enables the existing staff to do more work with less effort; costly emergencies and accidents are minimized, and many "trip-outs" avoided.

The first sound systems consisted simply of a microphone, amplifier, and loudspeakers enabling the person called to be located directly. Such systems conveyed intelligence; they could reach anybody, employed personnel as well as visitors and outside installation or servicemen.

The next step involved the placing of microphones around the plant so that anybody could pick up a microphone and call anybody else. This was the multiple microphone — multiple speaker system. In addition, of course, there was also the regular intercommunicating telephone system.

It was, therefore, logical to develop the third step, providing the system in use today. With multiple microphones, why not put in a receiver of some kind so that the party called could go to the nearest station and carry on a conversation with the party calling?

The degree of complexity of such systems can take either of the following courses:

1. A single-channel system whereby there is only one party line throughout the plant.
2. More than one party line so that several sets of people can carry on conversations simultaneously.

Keep Systems Simple

In considering the installation of sound systems it may be well to point out that many engineers and executives have a tendency to visualize or contemplate a system which is more complex than it needs to be. Experience has shown that, in general, a single party line system meets most of the operational requirements because conversations in a power plant are rarely prolonged. Also, the single

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Fig. 2. This view shows the handset installation on the condenser floor. Any failure or required adjustment of feedwater pumps, condensers, or other auxiliary equipment can be reported immediately and men promptly located to attend it

party line system eliminates confusion due to operational techniques, and multiple-person conferences can be quickly established without confusion.

The single party line has still another advantage in that means can be provided either in the main control room or the superintendent's office which will enable those in charge to monitor, on a loudspeaker, all the party line conversations even though these conversations may not be amplified by the main system. This is important because there may be occasions when two groups of workmen may be adjusting equipment in widely separate parts of the plant and communicating with each other in regard to what they are doing. Although they may be coordinating their respective adjustments, they may not be aware of the effect these adjustments may have on other parts of the system. They may not understand the over-all effect of their work. The superintendent or others charged with the over-all responsibility of the plant, however, may instantly see trouble ahead and thus will be able to step in and supply needed advice or instructions.

Another hazard inherent in the contemplation of a complex sound system is the tendency towards complete loudspeaker coverage of the plant where only partial coverage is needed. This can greatly increase the cost, in fact the attempt to cover the whole area of a plant, or 100 percent of the personnel, will increase the costs almost exponentially with the area. Sound systems should be designed to cover only the essential areas or the essential personnel.

In a very large plant where there might be occasion for heavy traffic between two points, it is often desirable to put in an auxiliary system to carry this local traffic.

Operation of Sound Systems

For the purposes of clear and instantaneous voice communication, for paging, or for making announcements, a well-designed sound system reduces the largest plant to the size of a room. When anyone in the plant wishes to speak to anyone else, he merely glances at the system's nearest handset to see if its *busy* light is on and, if not, picks it up. This connects him with the system's party line, and automatically cuts off the local loudspeaker to prevent acoustical feedback.

Pressing the button built into the handle of the handset, he calls the desired party by name or station — the call being heard over every other speaker in the plant. The called party picks up the nearest handset and replies.

If desired, the conversation may be restricted to the two stations in use by releasing the button. Additional parties can be asked to join in the conversation by the simple expedient of depressing the button and asking

Fig. 3. Cradle switch handset station for wall or desk-side installation. All terminals or moving parts are protected

Fig. 4. Straight axis directional loudspeaker. This unit provides high level sound with minimum acoustic distortion

Fig. 5. This is a re-entrant type loudspeaker which provides high-level energy over a relatively narrow angle

Fig. 6. A small version of the re-entrant type of loudspeaker for service in limited areas at high noise levels

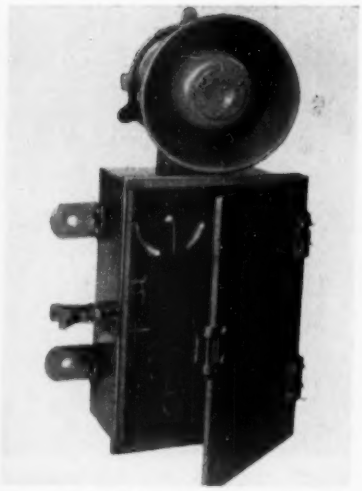


Fig. 7. For outdoor installations cradle switch handsets are housed in weatherproof boxes with removable watertight doors and various types speakers

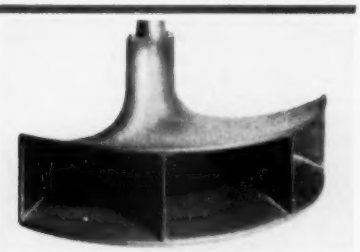


Fig. 8. Here is a speaker combining wide horizontal and narrow vertical angles for areas of special treatment

Fig. 9. Water-proof and corrosion-resistant speaker of the type recommended for the heavy moisture areas

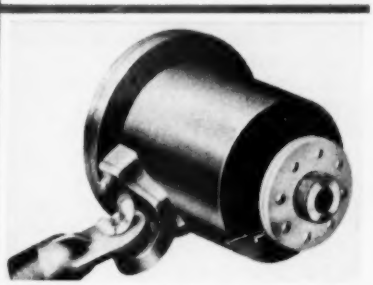


Fig. 10. An explosion-proof speaker for hazardous areas containing explosive dusts or gases is type shown here

Fig. 11. Power supplies, amplifiers, controls and test facilities are usually contained in sturdy, ventilated steel cabinet

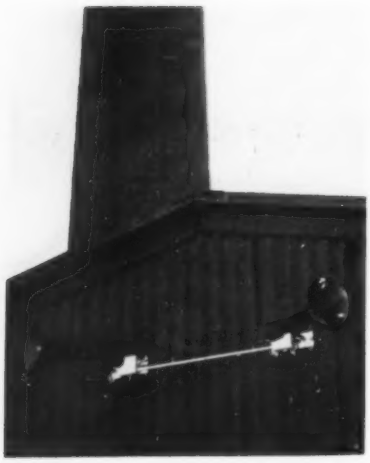


Fig. 12. Weather-proof outdoor loudspeakers can be connected for locating personnel or for some emergency alert

them to do so. What could be easier?

All that is necessary to use the system for public address purposes is to pick up a handset, depress the button in its handle, and speak. If desired, amplifier-loudspeaker combinations can be abridged across the system's party line or lines at selected points in such a way as to make all communications audible at such points for informational and evaluation purposes. Alternatively, special switches can be provided at such points, to throw on all loudspeakers during emergencies. As already indicated, however, such additional features should be avoided unless careful consideration or experience shows them to be necessary.

Design

In the design of a sound system the first two factors to consider are:

1. Select the points of intercommunication.
2. Select areas which you want covered with loudspeakers in order to reach the persons called.

After this has been done, the next step is to make a survey to determine the noise level and the physical space requirements of the areas to be covered. This will permit a competent sound engineer to do three things:

1. Select the proper type of loudspeakers. This involves determining:
   (A) The directional characteristics of the loudspeaker.
   (B) Special characteristics with respect to:
      1. Water-proofing (rain, flooding, etc.)
      2. Moisture-proofing (moist atmospheres)
      3. Explosion-proofing against gas or dust explosion hazards.
2. Specify the amount of energy to be put into the speakers.
3. Specify the location or orientation of the loudspeakers.

Having this information, the design of the basic system can be laid down. With the basic system decided upon, consideration can be given to the refinements that may be needed, such as monitoring facilities, busy lights, standby amplifiers, etc.

Units of Equipment

Once the type of system has been selected, consideration can be given to the design of the components which make up the system, that is, the handsets, the amplifiers, and the wiring.

Hanger assemblies for handsets should have following features:

1. Should not be affected by dust.
2. Should resist corrosion from atmospheric conditions involving (a) salt, (b) hydrogen sulphide, (c) sulphur dioxide. The latter two are especially prevalent in gas plants.

The cradle switch should have sufficient contact capacity to cut off speaker nearest handset in use so as to prevent acoustical feedback. The construction of these sets should be immune to damage from rough handling, and the terminal boards should be arranged for easy installation and access for servicing.

The handsets should be of a type to produce signals of relatively high level which will minimize inductive pickup on the communication circuits from other circuits and devices. The handset, also, should have circuitry to adjust side-tone level so as to minimize interference of local noise into the sender's own receiver and, thus, permit the user to obtain the maximum amount of sound energy from the party at the other end of the line and at the same time reduce the amount of noise interference at his location.

The amplifier system should possess the following characteristics:

1. Sufficient power to operate all loudspeakers so that each speaker will receive enough energy to override local noise.
2. That, at this power level, the amplifier distortion will not be greater than 5 percent.[1]

Maximum Intelligibility

The response of the amplifiers should be adjustable for maximum intelligibility by proper balance between low and high frequencies, and by removing the low portion of the frequency spectrum, that being the portion below cut-off of the speaker. The amplifier, furthermore, should have an automatic leveling device so that the amount of energy coming out of the speaker will remain relatively constant. This will permit the person who speaks in a low tone to be heard over the noise, and will prevent the person who talks excessively loud from overloading the system, thus permitting greater use of the audio power available and improving intelligibility.

Serious consideration should be given to pre-amplifiers of the plug-in variety to permit quick replacement in case of failure and easy servicing.

The power amplifiers should be in multiple with switching circuits to remove any defective amplifier. With the use of multiple amplifiers, even though one unit fails the others will carry on.

Wiring

The system and the wiring should be of a type which will permit a common conduit to be used for both inter-communication between handsets, the lines to the loudspeakers, and the control circuits.[2]

Some systems are designed to operate with as few as two pairs of conductors looping all stations. This type of system permits easy expansion because everything is in multiple.

Servicing and Maintenance

Other factors to consider in the selection and purchase of a power plant sound system are:

1. Does the manufacturer maintain, preferably under his own name, service facilities and spare parts within easy distance of the plant in which the sound system is installed?
2. Will the manufacturer provide technical installation supervisors to assist the plant people in the proper installation and adjustment of the system?
3. Will the manufacturer accept a contract for servicing and maintaining the equipment at a reasonable figure, which should include three items: (1) preventive maintenance service on regular schedule, (2) replacement of all worn parts and tubes, and (3) any emergency service requirements.

[1] Some systems are designed to operate with as few as two pairs of conductors looping all stations. This type of system permits easy expansion because everything is in multiple.

[2] Some systems are designed to operate with as few as two pairs of conductors looping all stations. This type of system permits easy expansion because everything is in multiple.

Editor's Note: In presenting this article, we wish to extend credit to the Engineering Products Dept., of the Radio Corporation of America for furnishing the photographs used in making the illustrations.

Anti-Flood Measures Keep Fort Dodge Operating

By H. NYE JOSLEYN

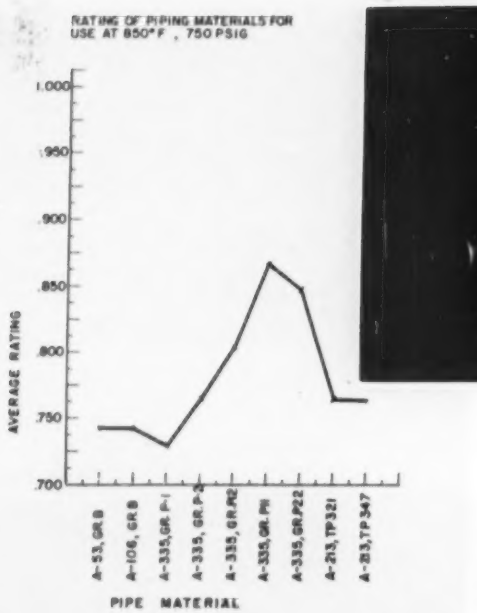
Fig. 1. Gardeners at the Fort Dodge, Iowa, power plant of the Iowa-Illinois Gas & Electric Co. did not have to worry about mowing the lawn during the week of June 20. An overnight rainfall of 7½ in. flowing into the already high waters of the Des Moines River covered the ordinarily well-kept lawns up to depths of 12 ft as in this view. The river finally crested at 19 ft. That the plant came through the flood without damage was credited to the precautions taken as shown here, following the slightly lower but more disastrous high water of the year 1947.

Fig. 2. Following the flood of 1947, all lower doors and windows were filled in and the entire basement waterproofed outside with 5 in. of blown-on special cement. Three 5-hp fans were installed to ventilate the basement. Two snorkel-like fan intakes are visible on the side of the building as shown. Also seen are waterproof high-voltage conduits leading to transformers; those conduits had been installed to replace the original tile conduits. The partially-flooded 2300/13,800-v transformers in the picture, having been previously installed on raised cement bases, were not damaged by the flood this time.

Fig. 3. Flooded area on the right-hand half of this view is outside coal storage area, holding normally over 6000 tons. Raised structure on the right is a double-track unloading trestle, one of which accommodates loaded coal cars, the other an electric locomotive crane. This is one way to put out a fire in a coal pile. Near lower left-hand corner of the main building is the river water screen house for incoming condenser cooling water. Proportion of the picture is indicated by two men in a rowboat at the left-hand corner of the big main power plant building during flood.

Curtiss D. Bassett* Answers the Question

Which Piping for High Pressure and Temperature?



Not gun barrels, but high pressure and temperature piping being manufactured in Japan for Detroit Edison's new River Rouge Plant

Rising fuel prices and other costs are inducing many industrials to increase their steam pressure and temperature. Here's a simple procedure for choosing the right piping material for these new, modern conditions

WHILE PUBLIC utilities and very large industrial companies have been using high pressure and high temperature, exceeding the elastic range of steel (to 700 F), in their steam power plants for several years, and have a working staff familiar with the economics and physical requirements of piping material for this type of service, this is not true of the average industrial firm. Only recently has the price of fuel and other costs risen sufficiently to induce small concerns to seek relief from the costs of self-generated power and steam by generating at temperatures and pressures well over 700 F and 700 psi; in other words, at conditions requiring steel pipe to operate in the plastic range of the piping material.

This article outlines a simple procedure for evaluating piping materials for service in the plastic range. Through its use, for any given temperature and pressure, a very definite choice can be made from a group of available materials. Whereas choice of piping in the elastic range of steel, i.e. up to 700 F, is largely a matter of price, in the plastic range the choice is based upon five factors, all weighted equally. These criteria are the creep rating, ductility rating, flexibility rating, corrosion rating, and cost rating for each material being considered.

For service at temperatures below 900 F, i.e. in the range 700 to 900 F, the corrosion rating is unnecessary since steam atmospheres do not become oxidizing below 900 F (1). (References at end of article.) Thus, in this range, the final choice is made on but four factors, viz. creep, ductility, flexibility, and cost, all weighted equally.

A subsequent article will explain why these factors are given equal weight.

Similarly, at temperatures below 800 F, the embrittlement problems associated with high temperature do not appear, and so in this range (700 to 800 F) the ductility rating may be dropped and the material rated by only three factors, viz. creep, flexibility, and cost, again all factors which are given equal weighting.

A lengthy bibliography used by the writer to set up evaluating criteria follows this paper. It is suggested that this list be consulted for detailed information on these factors.

The rating method is best explained by working out an example. Consider, for instance, the main steam piping for a new boiler installed in a paper mill power plant for operation at 750 psi and 850 F. The size of the piping is 8 in. nominal. Table I presents a list of piping materials suitable for these conditions (2) together with a tabulation of alloying elements in each, the allowable stress ("S" value) at temperature, the required pipe wall thickness, and the nearest standard pipe thickness or schedule above that required.

Creep Rating

The allowable stress ("S" value) for piping to be used in the plastic range of steel is determined from the creep strength or rupture strength of the material (2). The "S" values are used to determine the required pipe wall thickness given in Table I. They are also the basis or criterion for the creep rating, as shown in Table IV.

Note in Table I that the medium chrome-moly steels A335-P11 and P22 have the highest "S" value, viz. 14,400 psi. Using this as a base, i.e. 14,400 psi equals 1.000, the other materials are rated on the ratio of their

* Engineer, Cummins & Barnard, Inc., Consulting Engineers.

creep strength or "S" value to this base. Thus the creep rating of A-53 is 7800/14,400 or 0.542, etc. The creep ratings are entered in Table II in the appropriate column.

Ductility and brittleness are important at high temperatures and are reflected in ferritic steels by the tendency to graphitize at prolonged service over 800 F (3) (1). These problems have been resolved most successfully by low alloy additions rather than by heat treatment (4) (Table V). The role of low alloy additions in controlling graphitization and chrome-embrittlement plus other control methods are discussed in papers listed in the references at the end of this article.

Ductility Rating

In Table II ferritic steels are given a rating of 1.000 if they are silicon killed, have a carbon content less than 0.20 per cent, and have a chrome content of 1.0 per cent. Each of these three criteria are weighted equally. Thus carbon steel A-53 has a rating of 0.667 because, although it meets the silicon and carbon requirements, it contains no chromium, and so loses one third of the possible ductility rating it could have.

In the same way low chrome-moly steel A335-P2, although it meets the silicon and carbon requirements and scores 0.667 for these additions, can only be rated on its minimum 0.5 per cent chromium content. Thus its ductility rating comes to 0.667 plus 0.166 or a total of 0.833.

Austenitic steels have a rating of 1.000 if their carbon content is less than 0.15 per cent and they are stabilized for welding with additions of either titanium or columbium. Equal weight is assigned to each of these two rating criteria.

Flexibility Rating

The flexibility rating is the writer's own method of evaluating the problems encountered in the mechanical design of a piping system using any one of the above piping materials. These problems arise from the thermal expansion of the pipe as it is heated, i.e. a high coefficient of thermal expansion (e) is unfavorable, and a low one is favorable.

Since the pipe has the same thermal expansion regardless of wall thickness, the force it exerts upon anchors and equipment increases with increased wall thickness. Likewise internal pipe wall stresses due to temperature difference between the inside and the outside of the pipe increase with increased wall thickness [5]. Thus the thinnest pipe wall consistent with good design is favorable.

At these high pressures thermal expansion of the pipe can only be absorbed by expansion bends. The pipe in these bends flexes or deflects under the moments caused by thermal expansion in inverse proportion to the modulus of elasticity (E) of the material and the moment of inertia (I) of the section. Thus a low value in either of these criteria is favorable.

To sum up, the flexibility rating, shown in Table VI, is a function of modulus of elasticity, moment of inertia, coefficient of thermal expansion, and wall thickness expressed as follows:

$$\text{Flexibility Rating} = f\left(\frac{1}{E}, \frac{1}{I}, e, t\right)$$

Table III lists the four properties mentioned above for the nine different pipe materials under consideration. All four criteria are given equal weight in the evaluation; that is, it is possible for each characteristic to score as high as 0.25.

Assigning the rating 0.25 to the lowest value of each of the above four characteristics found in Table III, viz. I = 72.5, E = 23.4, e = 7.12, and t = 0.322, and comparing the actual characteristics of each material in turn against these lowest values, each pipe material is scored for flexibility as shown. These flexibility ratings are also entered in Table II, which is the final score sheet.

Corrosion Rating

Corrosion rating of the pipe materials for these steam conditions is unnecessary since in a steam atmosphere oxidation is not promoted below 900 F (1). For temperatures over 900 F the corrosion resistance is a function of the carbon, chromium, and silicon content (1).

Cost Rating

In rating each material on cost the price per hundred feet for bare pipe

continued on page 102

Table I. List of the seamless steel piping materials suitable to be used at 850 F [1]

Pipe	ASTM Spec	Grade	Alloying Elements—Per cent Al	C	Si	Mo	Cr	Ni	Ti	Cb	S Allow. Psi	t Reg. Wall In.	Nearest Std Pipe Sch.	t Act. Wall In.
Plain Carbon	A-53	B	—	0.08 0.20	0.25 Max.	—	—	—	—	—	7,800	0.523	100	0.593
	A-106	B	—	0.08 0.20	0.25 Max.	—	—	—	—	—	7,800	0.523	100	0.593
Carbon Moly	A-335	P-1	—	0.08 0.20	0.10 0.50	0.45 0.65	—	—	—	—	13,150	0.343	60	0.406
Low Chrome Moly	A-335	P-2	—	0.10 0.20	0.10 0.30	0.45 0.65	0.5 0.7	—	—	—	13,150	0.343	60	0.406
	A-335	P-12	—	0.15 Max.	0.30 Max.	0.45 0.65	0.80 1.10	—	—	—	14,200	0.324	60	0.406
Medium Cr-Mo	A-335	P-11	—	0.15 Max.	0.50 1.00	0.45 0.65	1.00 1.50	—	—	—	14,400	0.321	40	0.322
	A-335	P-22	—	0.15 Max.	0.50 Max.	0.90 1.10	2.00 2.50	—	—	—	14,400	0.321	40	0.322
Austenitic Stainless	A-213	TP-321	—	0.08 Max.	0.75 Max.	—	17.0 20.0	9.0 13.0	.60 Max.	—	14,300	0.322	405	0.322
	A-213	TP-347	—	0.10 Max.	0.75 Max.	—	17.0 20.0	9.0 13.0	—	1.00 Max.	14,300	0.322	405	0.322

[1] Code for Pressure Piping, A.S.A. B 31.1 a—1953 with Supplement No. 1

Table II. Final score sheet for selecting best piping metal

Pipe	ASTM Spec.	Grade	Creep Rating	Ductility Rating	Flexibility Rating	Cost Rating	Average Rating
Plain Carbon	A-53	B	0.542	0.667	0.759	1.000	0.742
	A-106	B	0.542	0.667	0.759	1.000	0.742
Carbon Moly	A-335	P-1	0.913	0.667	0.876	0.456	0.728
Low Chrome Moly	A-335	P-2	0.913	0.833	0.879	0.427	0.763
	A-335	P-12	0.986	0.933	0.880	0.408	0.802
Medium Cr-Mo	A-335	P-11	1.000	1.000	0.978	0.481	0.865
	A-335	P-22	1.000	1.000	0.978	0.403	0.845
Austenitic Stainless	A-213	TP-321	0.993	1.000	0.935	0.125	0.763
	A-213	TP-347	0.993	1.000	0.938	0.118	0.762

Table III. Properties of the nine metals being considered

Pipe	ASTM Spec.	Grade	E × 10^6 Sq In.	I In.^{4}	e In./100′	t Actual In.	Cost * $/100′
Plain Carbon	A-53	B	25.7	121.4	7.25	0.593	408.66
	A-106	B	25.7	121.4	7.25	0.593	408.66
Carbon Moly	A-335	P-1	25.7	88.8	7.25	0.406	896.68
Low Chrome Moly	A-335	P-2	25.7	88.8	7.15	0.406	957.50
	A-335	P-12	25.7	88.8	7.12	0.406	1001.60
Medium Cr-Mo	A-335	P-11	25.7	72.5	7.12	0.322	850.30
	A-335	P-22	25.7	72.5	7.12	0.322	1013.00
Austenitic Stainless	A-213	TP-321	23.7	72.5	9.47	0.322	3268.26
	A-213	TP-347	23.4	72.5	9.47	0.322	3463.69

* Based on current prices furnished by National Tube Div.

Fig. 1. Night view, Joppa Steam Electric Station at Joppa, Illinois, just across the Ohio river from AEC plant in Kentucky

Shawnee and Joppa—Race of the Power Giants

Though few giant generating stations have had as much publicity during construction as Shawnee and Joppa, many readers are not clear about their relationship and why they have attracted so much attention. Here is a description of their background and progress

By PAUL C. ZIEMKE

Fig. 2. Aerial view of Shawnee Steam Electric Generating Station, built by TVA

ATOMIC ENERGY Commission has been the nation's heaviest single power user for many years and TVA has supplied this need quite unassisted with the exception of the early years of atomic materials production when private power producers in the midwest directed all their spare capacity into TVA power networks. At Pudacah, approximately one half of the Commission's needs will be met by the TVA and the balance by private interests.

Back in 1950, the Atomic Energy Commission requested the Authority to consider a proposal for furnishing 1,000,000 kw of power for its gaseous diffusion plant at Paducah.

Opposition to the deal developed among private power interests who desired to share in the load requirements of the Commission. Thus, in December of 1950, the Commission entered into an agreement with a private company to furnish one half of the power required to turn the wheels of the giant diffusion plant. The power needs for atomic material producing plants must be extremely dependable since production suffers seriously when power outages occur.

More Power—More Suppliers

The block of power needed exceeded the ability of one company to furnish it unaided. A combine of five companies — Central Illinois Public Service Co., Illinois Power Co., Kentucky Utilities Co., Middle South Utilities Incorporated, and Union Electric Co. of Missouri, formed a unit named Electric Energy, Inc. At Paducah, approximately half the commission's needs will be met by TVA and the balance by the private firms.

Decision to purchase private power resulted in planning by EEI for Joppa plant, to be located approximately 22 miles northwest of Paducah on the north shore of the Ohio River.

Figures 2 and 4, courtesy o the author; Figs. 1 and 3, The Bechtel Corporation

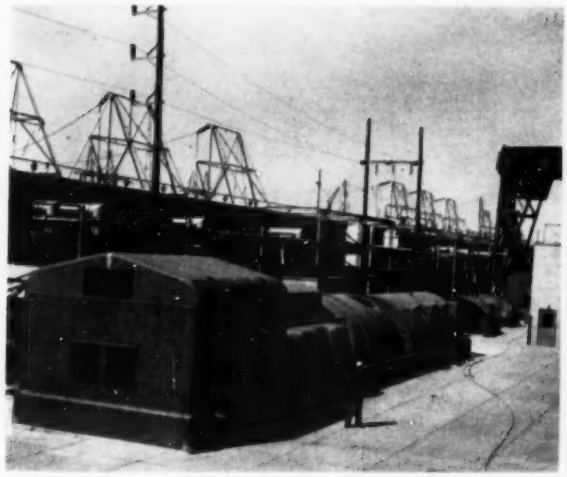


Fig. 3. One of Joppa's six 163,000 kw outdoor type units

Fig. 4. Some of Shawnee's ten 150,000 kw generating units

January of 1951 saw hectic action on the part of TVA as its design departments readied plans for the small army of engineers converging on the Shawnee building site. Two years and three months from the time the first bulldozer plowed a furrow, the first generator unit at Shawnee was placed on the line to meet scheduled power demands of the rapidly expanding AEC plant at Paducah. By January 1954, four units were in operation.

Construction Progress

The present rate of construction shows high promise for completing the entire project within the time scheduled, with the fifth unit going into service late this fall. The goal is set for a cost of $145 per kw.

Shawnee steam plant conforms to general engineering ideas with no radical departures from conventional design. All units are housed in structural steel and brick buildings.

There are to be 10 power producing units in the plant, each unit consisting of a boiler plus a turbine generator, and auxiliaries. Full details of Shawnee were given in the September 1952 issue of POWER ENGINEERING. Fuel in ample supply is available from the mines in western Kentucky and southern Illinois. Shipment will be by barge and railroad with the bulk arriving by water. Total coal consumption will be 14,000 tons per day for the 10 power units.

Early Labor Difficulties

As with the neighboring power plant at Joppa built by Ebasco Services, labor disputes marred the early Shawnee production schedules. A series of unauthorized walkouts proved troublesome, and a total of 30-odd such delays had to be negotiated before work could be resumed. In recent months peace has reigned. Some concept of the size of the job can be gained from the fact that in early stages of 1953 there were 3,200 workers on the project. Currently there are 2,400 men employed on the completion stage of the job.

Joppa Catching Up

Labor disputes that tied up the Joppa project for extended periods have finally been settled with hopes that the $195,000,000 steam plant will see completion in the fall of 1955. The labor peace that has existed since October of 1953 has speeded up construction, and 2,500 men are now making their presence known through compliance with tight work schedules.

Every effort is being made at Joppa to overcome the handicap of the labor stoppages of the early days. This handicap is generally recognized as the reason why the Joppa plant was not the first to begin furnishing the urgently needed power for the gaseous diffusion plant of the Atomic Energy Commission at Paducah.

According to the original arrangements made between the Commission and the Electric Energy, Inc., half the required Paducah power would be furnished by the corporation. Plans called for the completion of the first privately-built unit to go on the line three months ahead of the initial TVA turbine generator.

While Ebasco Services undertook the responsibilities of the original prime contract, to be achieved with their own forces, the succeeding series of labor disputes and the resulting work stoppages resulted in a re-evaluation of the whole program by the interested parties. On July 30, 1953, soon after the second of the six generators was producing power, Electric Energy, Inc., terminated its contract with Ebasco Services. The reorganization was deemed necessary because of the lack of productivity and consequent increased cost characterizing the work thus far.

Under Bechtel's management the first Joppa turbine generator went into power production in July of 1953, with the second unit going on the line a few weeks later. The third unit followed in short order and the fourth was scheduled to begin production of power on June 1. This leaves the fifth and sixth generators which will be operative in the fall of next year. With all six units producing, the output will total 937,500 kw.

Like its TVA counterpart, Joppa plant will burn coal delivered primarily by river barge with the balance being supplied by rail. The consumption of fuel will be somewhat under the needs of TVA's Shawnee since only 10,000 tons per day will be needed. Full details of Joppa were given in the November 1952 issue of POWER ENGINEERING. Joppa is now approximately 65 per cent complete. Unlike Shawnee, which is entirely housed, Joppa is completely outdoors.

Rate Differentials

Rates offered to the Atomic Energy Commission by the Authority, and Electric Energy, Inc., differ in some degree. Both TVA and the private firms include a basic rate in their contracts, based on estimates of the cost of the building of steam plants and of operating and maintaining them after they are placed in service. The basic rates are, however, subject to escalator clauses.

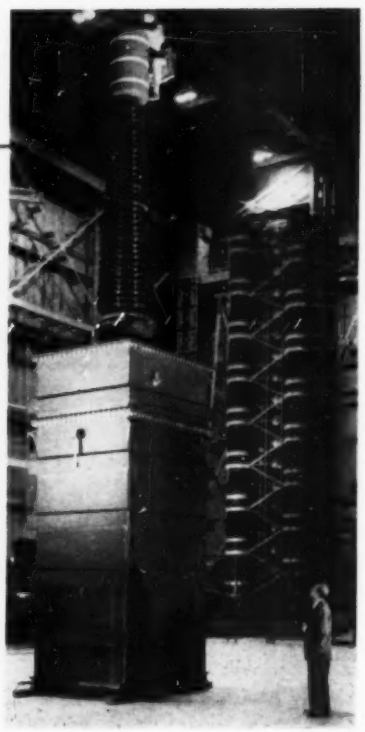
The TVA rates are projected on the basis of national building cost indices as given by the leading construction publications. Rates, therefore, are affected only by the changes in costs over which the Authority has no control.

The private firms base their escalators on the cost they actually experience, thus for all practical purposes having a cost-plus contract.

Joppa, incidentally, is expected to cost $184 to $188 per kw — figures which have been so affected by the cost of the many labor disputes that they no longer have significance in any comparison between the cost of indoor or outdoor construction, or the cost of construction by private or public power companies.

News Reel

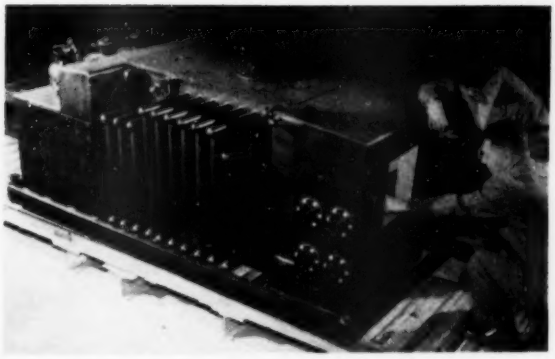
A. C. Monteith, new president of the AIEE, gets in some throat-clearing and cribbing while Bradley Cozzens has his say. Monteith (second from right) will continue as vice president in charge of engineering and research for Westinghouse after taking office August 1st. Shown (l. to r.) are: Bradley Cozzens, general chairman; Elgin B. Robertson, retiring president; Monteith; and H. H. Henline, secretary (retired). Meeting was held at the Los Angeles Biltmore



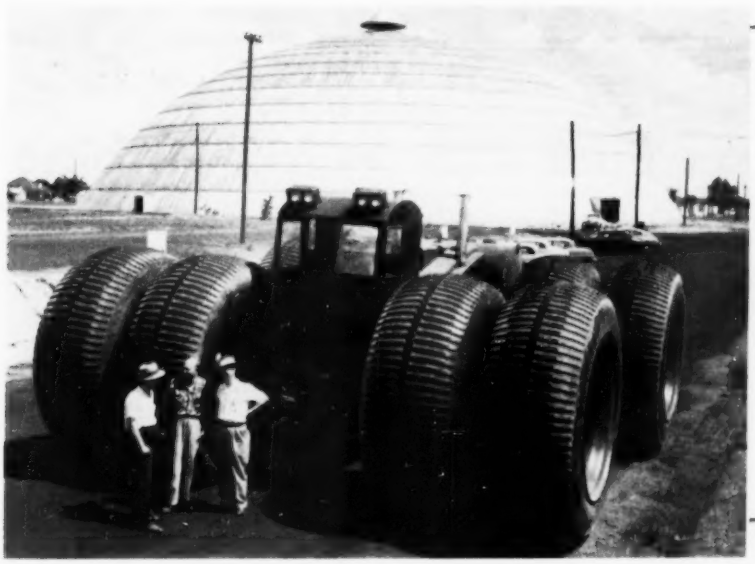
G.E.'s new potential transformer is sized up by its design engineer, Dr. L. W. Marks. We are told that it is the world's largest, weighing 50,000 lb, 33 ft high, etc. No rating data were given

Dow's new 90-ton compressor comes to roost on its permanent foundation at their Freeport, Texas, ammonia plant. It is one of two being installed to double the plant's capacity. The Austin Co. expects to complete the job early next year

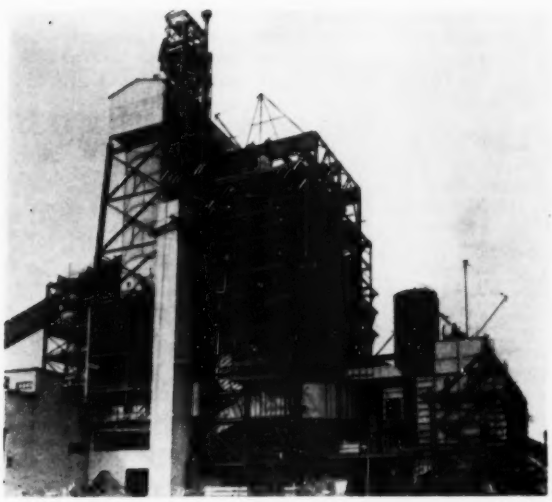
Sensitive and quick-acting, this Baldwin-Lima-Hamilton balancer uses strain gage wires bonded to a supporting rod (top) and reports unbalance of fan rotor (center) on dial



Unusual 150-kva load-center, specially designed by G.E., will be installed in Sominar's tungsten mine at Los Condores, Argentina, as part of their in-mine power distribution system



'Sno joke—it's for real. LeTourneau came out with the queer-looking Semi-sphere Building a few months ago (background), and now they have something to park in the driveway. This "Sno-Buggy" with its eight 10-ft tires weighs 23 tons, has individual motors on each of the four wheels, and is powered by a 400-hp engine-generator set. Speed when on deep snow, boggy swampland or loose sand is eight mph—forward or backward, though we can't tell which is which. It is intended for exploration and development of areas not suited for conventional vehicles



Pennsylvania P & L's plant at Martin's Creek has a new Research Corp. electrostatic precipitator to process 500,000 cfm of flue gas from a 1,200,000 lb-per-hr steam generator

Dominion Bridge has erected one of the two huge control gates they designed and built for the tunnels carrying water under Niagara Falls, Ontario, to the Sir Adam Beck Station

Fig. 1. General view of Flatiron Power and Pumping Plant. It contains first U. S. reversible two-speed pump-turbine unit, rated 13,000 hp as a pump, 12,000 hp as a turbine, plus two conventional 48,000-hp hydroelectric generating units

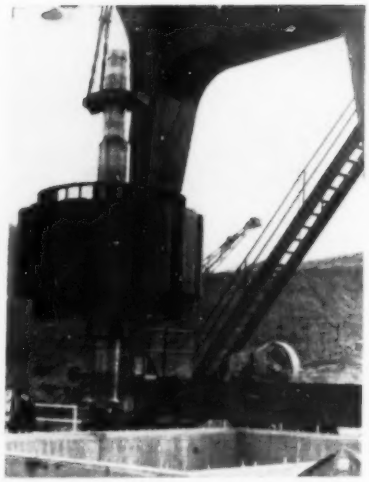


Fig. 2. This is a generator rotor at Flatiron plant being lowered into place for installation, by the big 100-ton gantry

Flatiron Tests First U.S. Pump-Turbine

Latest development in hydraulic turbine field is reversible two-speed pump-turbine at Flatiron Power and Pumping Plant in Colorado-Big Thomson Project near Denver, Colo., built by Bureau of Reclamation. It stores water for irrigation. Stored water operates unit as turbine to generate up to 8500 kw. The station has two other 35,000-kva units

AT FIRST the synchroscope pointer spun around the dial very fast, then more and more slowly as the operator manipulated the controls, Fig. 3, on the new reversible pump-turbine at Flatiron Power and Pumping Plant. He was bringing the unit on the line to ready it for its first official test as a turbine for generating electric power. The group of men standing behind the operator, Fig. 3, was silent as he brought the unit very carefully to synchronous speed. They were the men who had designed and built it.

Then, as the synchroscope pointer crept slowly — slower — slower — up to the top of the synchroscope dial, the operator pushed the breaker button just a fraction of a second before the pointer touched the mark. There was a thud as the breaker went home — and the unit was on the line. It was 11 A.M. on June 8, 1954.

Now there were broad smiles on the faces of those men in Fig. 3. They had tested the unit as a pump the week before, knew it was a good pump. They had tested all the electrical controls, too, and knew they worked right. This turbine test was the final one, and everybody was pleased. So far, not a hitch. Everything smooth as a Swiss watch. And the unit had no governor! It was regulated solely by the butterfly valve with a 6-in. bypass around it. It had two speeds: one for pumping; another, a bit lower, for generating.

Test of Unit as Turbine

After the unit was synchronized, the operator opened the butterfly valve wide and the pump-turbine picked up load quickly until it was carrying 6700 kw at a head of 223 ft. It is rated at 8500 kw at 290 ft head, but before this test the reservoir water had to be drawn down to meet irrigation needs. Hence the unit could not be tested at full head; that would have to wait.

The engineers allowed the unit to operate at this 6700-kw load for a little over an hour, so it would "warm up" and all factors would reach steady values. At 12:15 P.M., the unit was operating steadily to the satisfaction of the test engineers — bearing temperatures O.K., oil to the Kingsbury O.K., generator temperatures O.K.

So, at 12:15 P.M., they began the official test of the unit as a turbine. Some of the engineers calibrated manometers, as shown in Fig. 4, for use in future tests, and a salt-velocity measurement of water flow to the turbine was being run at the same time. Various readings were taken from test instruments on a predetermined schedule under the supervision of one of the Bureau's most experienced test engineers.

Fig. 3. Construction and power engineers watching Flatiron operator put pump-turbine on line for its first official test as a turbine on June 8, 1954

Fig. 4. During first test of Flatiron pump-turbine as a turbine, Carl Bates, Bureau of Reclamation engineer, and assistant G. H. Johnson, calibrate manometers for use in future tests

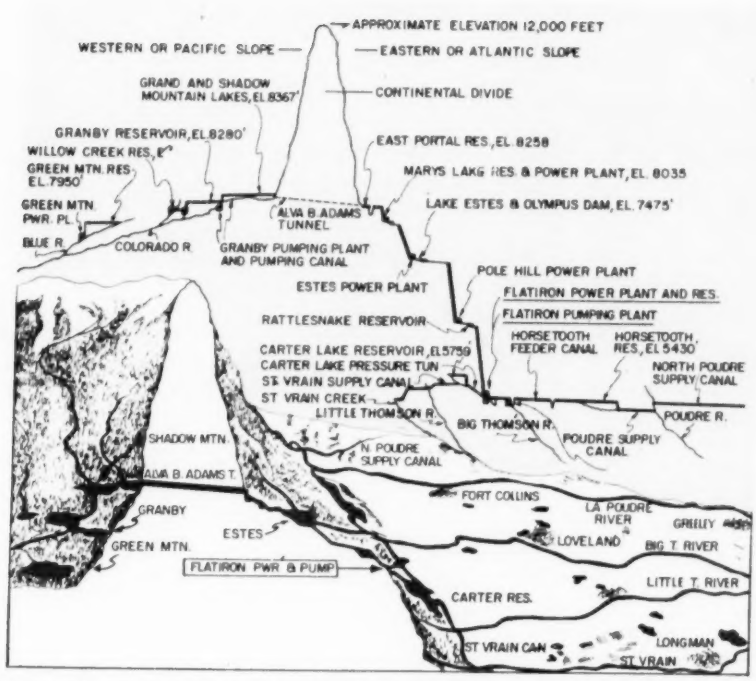


Fig. 5. Diagrams of Colorado-Big Thompson Project of Bureau of Reclamation for supplying water from western slope of Continental Divide to augment inadequate irrigation waters on eastern slope. Top—elevation diagram; bottom—perspective diagram. Flatiron is at bottom of hydraulic ladder on eastern slope

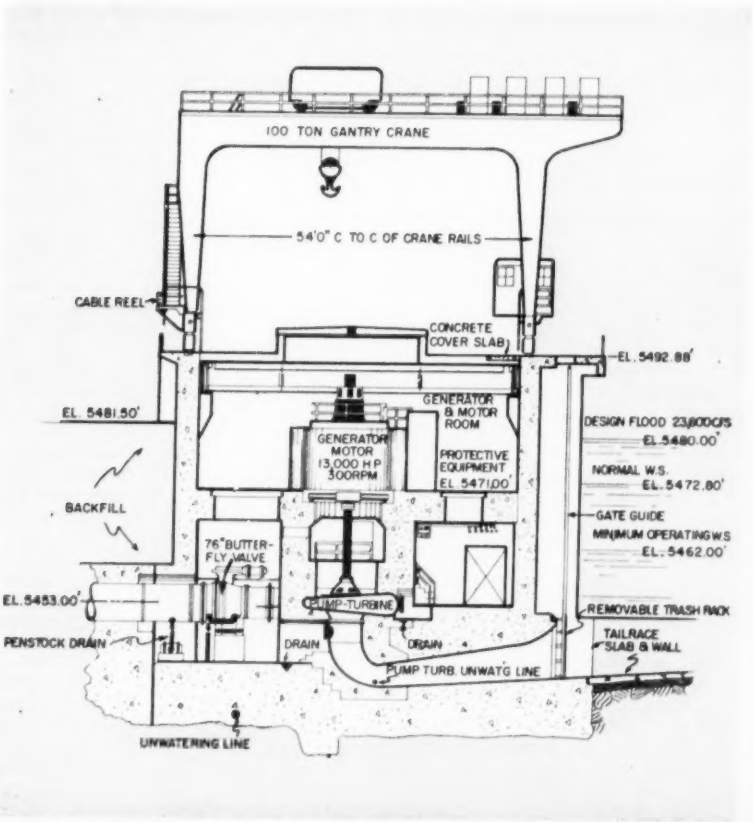


Fig. 6. Cross-section through Flatiron Power and Pumping Plant at pump-turbine

Preliminary results of these tests indicate that the unit has exceeded its guarantees both as a pump and as a turbine. Final test results are to be reported later and a detailed discussion of the way the combination generator-motor is designed, operated and controlled for two-speed operation will be presented later.

Here, after several years of development work, is the first of a new type of unit to be installed in the United States. It has a single runner, operating as pump to store water in a reservoir, when driven in one direction by a motor; and then, using the stored water, reversing its rotation to drive that same motor as a generator to produce electric power; and it operates at different speeds in each case.

What Is Flatiron?

In the Flatiron plant, object of using such a unit is to take water being pumped over the Continental Divide near Denver, Colorado, pump it into a storage reservoir for a large irrigation system and then, as the water is required for irrigation, let the water flow back through the unit and generate as much electric power as possible, to be delivered into the project's existing electric transmission system.

Flatiron Power and Pumping Plant, in which the new reversible pump-turbine is now operating, is an important link in the entire development known as the Colorado-Big Thompson Project of the Bureau of Reclamation in Colorado, shown in Fig. 5. This project is designed to collect surplus water on the western side of the Continental Divide, in a stepladder series of lakes as shown. This water is pumped and prodded up the ladder of lakes to the mouth of the Alva B. Adams tunnel, which bores 13 miles straight under the backbone of the Continental Divide. From this tunnel, the water pours down the eastern slopes and foothills of the Divide to irrigate about 750,000 acres of rich but inadequately-watered farm land in an area north of Denver.

As the water flows down the eastern slope of the Divide, its power potential is utilized in a series of hydroelectric plants at Mary's Lake, Estes, Pole Hill, and Flatiron.

All power generated in these plants is fed into a power system covering the irrigated area. Completed power system facilities include 38 permanent substations and over 780 circuit miles of transmission line. Distribution of water to the irrigation system and of power to the various parts of the electric transmission system are both controlled from a large dispatchers' building about ½ mile from the Flatiron plant.

Green Mountain Reservoir, dam and power plant were described in POWER ENGINEERING, August 1943 issue; Granby Pumping Plant in the July 1949 issue. First account of the

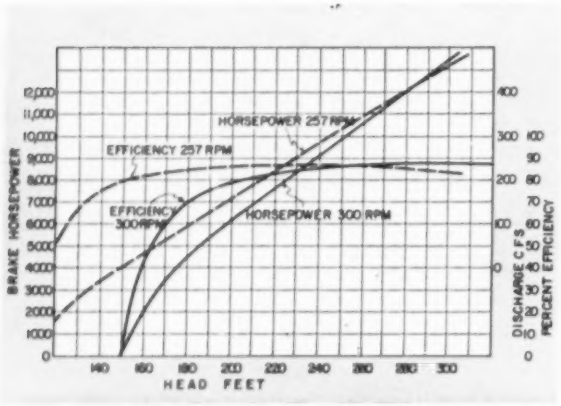


Fig. 7. Model of reversible pump-turbine, tested as a turbine at the two operating speeds, gave these curves. Unit will generate at 257 rpm, on flatter and better efficiency curve

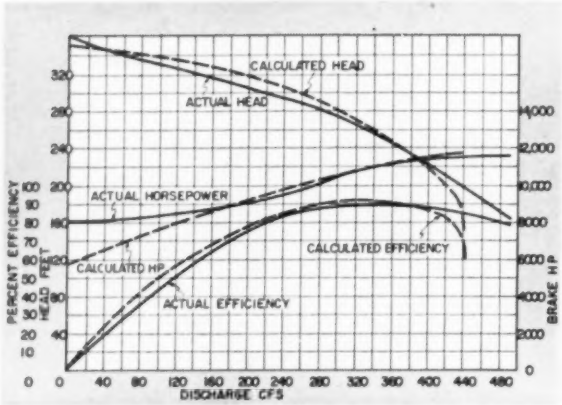


Fig. 8. Model of reversible pump-turbine, tested as a pump, gave the actual curves shown, compared to original calculated performance, figured for 370 cfs, 240 ft head, 300 rpm

proposed design for a reversible pump-turbine unit was published in our July 1950 issue and an article on pumped storage hydroelectric power appeared October 1951 issue.

General Design of Flatiron

Flatiron Power and Pumping Plant is a peak-load plant for the power system and a pumping plant for storing water for the irrigation system in Carter Lake Reservoir, which provides about 114,000 acre-feet of storage capacity. Such storage is important at this point not only to the irrigation system, but also as a help in regulating system operations in the whole project.

Water flows from Adams Tunnel through the various power plants and reservoirs, through Bald Mountain pressure tunnel to the Flatiron penstocks. These are two steel penstocks, Fig. 1, about 5800 ft long, 84 in. in diameter at upper end, 72 in. near the plant, terminating in 84-in. butterfly valves in the power house.

These penstocks deliver the water to two conventional hydroelectric generating units, Nos. 1 and 2, in the power house. When the pump-turbine, Unit No. 3, is operating as a pump, it takes suction from the Flatiron afterbay and pumps the water up to Carter Lake Reservoir, where it is held in storage pending a need for it in the irrigation systems. When it is so needed, water flows back down through the pump-turbine into Flatiron afterbay, then on to the irrigation system. Water may also be drawn direct from Carter Lake Reservoir into the irrigation system.

Units Nos. 1 and 2 at Flatiron each consists of a Pelton Francis-type hydraulic turbine rated at 48,000 hp at 1055 ft head, driving a Westinghouse 33,000-kva, 13,800-v, 0.90-pf, 3-phase, 60-cycle generator at 514 rpm. These units are classed among the highest-head Francis-type units built in this country. Also they are the first used by the Bureau of Reclamation at heads over 1000 ft. They are equipped with wicket gates and Woodward governors and operate in the conventional manner. They deliver their power to an outdoor substation, right Fig. 1, 35,000-kva (air-cooled) 46,667 kva (forced air rating), where it is stepped up to 132,000 v for connection to the transmission system.

Flatiron pump-turbine unit, as stated, is first of its type to go into operation in the United States. (Second pump-turbine unit is now being built for installation at Hiwassee Dam of TVA.) The Flatiron unit was designed by the Bureau of Reclamation engineers and Allis-Chalmers Mfg. Co. engineers working in close cooperation, and was built by Allis-Chalmers, which is also responsible for the motor and generator construction and controls that permit the two-speed operation.

Pump-Turbine Details

This pump-turbine unit consists of a single specially-designed pump having fixed-vane hydraulic turbine type casing and driving a single generator-motor. This unit rotates in one direction as a pump, in the reverse direction as a generator. The two-speed operation is a novel feature, as is also the omission of wicket gates and governor. Control of the unit is by means of the 76-in. butterfly valve alone. This butterfly valve has a 6-in. bypass around it, with a valve in it, for vernier adjustments in controlling the speed of the unit.

Operating as a pump, the pump-turbine is rated to deliver 370 cfs against 240 ft head, driven by the generator-motor operating as a synchronous motor rated at 13,000 hp, 9698 kw, 13.8 kv, 1.0 pf and 300 rpm. As an a-c-generator, the unit is rated to develop 8500 kw at 1.0 pf, 13.8 kv, 3 phase, 60 cycles, operating at 257 rpm, at a head of 290 ft. Pumping head will vary from 170 to 300 ft, turbine head 290 to 140 ft.

Entire rotor assembly of generator-motor, shaft and pump-turbine runner is supported by a Kingsbury thrust bearing arranged for pressure lubrication, so that it can support the weight of the rotor assembly on a film of oil when starting, giving low starting torque.

No Wicket Gates, No Governor

As noted above, the unit has no wicket gates and no governor nor regulator. When starting as a turbine, the unit is synchronized by adjusting the butterfly valve shown in Fig. 6. First, the valve is opened a small amount to admit water to bring the unit up to about 95 per cent of normal speed. Then, by adjusting the valve in the 6-in. bypass around the butterfly, the unit can be brought to normal speed and put on the line. Then the butterfly valve is opened to full opening and the generator output will correspond to the head available from Carter Lake Reservoir at that time.

Another method of synchronizing would be to start the unit with the butterfly valve, bring it up to about 200 rpm, then motor the unit up to synchronous speed, then synchronize for generating and then open the butterfly valve wide. The generator-motor is equipped with amortisseur windings and will start in either direction.

While the unit can operate as a generator at either 300 rpm or 257 rpm, depending on the electrical connections used, it is designed to develop more horsepower and better over-all efficiency at 257 rpm. Similarly, best over-all pumping efficiency is obtained at 300 rpm. Curves of Figs. 7 and 8 show the performance characteristics based on tests of a model.

To start the unit as a pump, it will be unwatered by compressed air, which will force the water down in the draft tube and leave the runner free to turn in air. Then, with the butterfly valve closed, the motor, which is designed for full-voltage starting, will start at *continued on page 100*

Power Plant GRASP
Vapor Tension and Superheat

In this second article on the principles of applying common-sense reasoning to power plant operating problems, the author cites personal experiences with experts who grapple with theories they know but do not fully understand. He shows how ordinary logic enables you to reason out puzzling aspects of vapor tension and superheat

By FRANK H. BROWNING *

WE STILL think that steam is one greatly misunderstood subject. It appears that many otherwise well-educated men work their problems from steam tables — pages and pages of numbers — and are satisfied with numerical results, without real sense of how it works. We can get numerical answers out of marvelous calculating machines, but not reasons.

Some years ago we discussed several subjects with the College of Forestry staff at a leading university. The top professor of Utilization was then experimenting with high temperature dry kilns on certain woods. Instead of having to evaporate all the water from green lumber, he was surprised to discover that much of the water ran out freely in liquid form, and he couldn't account for that unexpected result.

Without getting bogged down in a maze of technical data, let's take two common facts. We know most trees — soft woods especially — float when cut. And we know that wood which soaks a long time finally gets "water-logged" and sinks. These facts show us that the solid part of the fibres must be a lot heavier than water, and that even the very wet, fresh-cut tree contains enough air or gas in the spaces between fibres to keep the whole log afloat until part of that gas is displaced by water.

The Forest Products Laboratory gives the specific gravity, but we'll only say the solid part of wood is about as heavy as sand or concrete. We must assume that the gas pressure in the tiny spaces of newly cut lumber is at atmospheric pressure, otherwise some air would find its way in, or be expelled from the living tree. No doubt every power plant student, operator, and consulting engineer has heard this important fact, but various mistakes in industrial processes prove it didn't sink in.

Vapor Tension Properties

In contact with water, the vapor tension or steam pressure is entirely independent of any other contents or gas pressure in the same space.

It makes no difference whether it is surrounded by a near vacuum, atmospheric pressure, or 2000 psi of compressed air, water at any certain temperature will *add* enough vapor in the adjoining space to maintain its corresponding pressure of vapor in contact with the liquid. We call it vapor below 212 F and steam pressure above, but it's all the same gaseous form of water at varying density. Round figures for vapor tension and corresponding water temperature are:

Temperature degrees F	Pressure psia	psig
80	½	—
100	1	—
125	2	—
150	4	—
180	8	—
200	12	—
212	15	0
250	30	15
280	50	30

It's so simple once a fellow sees it. When the wood is heated to the stated temperature, the gas content between the fibres is increased by the corresponding number of pounds listed, and this pushes free liquid water out as the extra gas tries to escape. Water and gas will be expelled until atmospheric balance is restored. The higher we heat the wood, the more vapor pressure is added, and the more free water and gas will come out. Once the wood reaches 212 F or a trifle above, vapor tension will equal or slightly exceed atmospheric pressure.

At or above this temperature the steam pressure will constantly replace itself when some escapes, so none of the original air can then remain in the wood spaces, except for some locked cells where it will seep through the walls more slowly. That means all *free* water will be expelled as liquid by heating the lumber above 212 F.

Some of the water in green lumber is absorbed by the fibres, varying with the kind. The balance of the moisture content is free and easily removable. After this large quantity of free water is driven out by added vapor tension as the kiln heats up, the remaining water held in the fibres by absorption has to be evaporated. It will take more than the normal latent heat to pull it loose from the wood's natural affinity for moisture. This attraction is well known, for even bone dry wood will soon expand by absorbing considerable moisture when exposed to the air. We hope this clears up the unexpected results.

Several years ago a large pulp and paper company north of here decided to speed up production. This plant reduced the trees to a thick mat of pulp which was sent to other plants to make finished products. They were sure other parts of the huge paper machines could operate faster. The limiting feature seemed to be the drying rolls where the web of pulp ran alternately over and under a long series of rolls heated by steam.

More Heat from Superheat?

These large rolls already carried the safe working pressure limited by design, so the engineering executives and consultants naturally turned to superheated steam in the rolls to get faster drying and more output. Steam tables clearly show more heat and higher temperature in every pound of superheated steam, without raising the pressure, so their experts claimed the results would justify expensive superheater equipment. It didn't!

More recently the laundries in a distant city faced a serious handicap. Inspectors decided an accident was due to a certain fault in all that make of equipment, so the insurance companies drastically reduced the allowed pressure for many dryers in that region. The laundries could not maintain their normal output with slow drying, so called for technical help.

The methods of analyzing engineering problems expounded in this article have been used for 30 years by the author in his work as Engineer Examiner for the City of Seattle. Mr. Browning has developed a technique, as explained in the July issue, of getting his examinees to pick problems apart, question long-accepted ideas, get a real grasp of power operations.

He has utilized these methods in a book, *Steam Plant Errors*. If you would like to know more about this book, write to the Editor, who will tell you how to obtain it.

We think Mr. Browning's ideas and methods of approach are stimulating and provocative, but his opinions and expressions are his own and do not necessarily reflect those of your Editor. If you disagree with the author or his conclusions, send your comments to the Editor, who will forward them to the author.

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* Mechanical Engineer, Seattle, Wash. (Formerly Engineer Examiner, City of Seattle — see page 84, July 1954 issue.)
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The owners were shown that superheated steam could restore and even increase their previous rate, so again a lot of money was spent installing superheater equipment. It did no good.

Where Is Error?

The results were sad in both these cases. Was something wrong with the steam tables? Or did they need someone with more practical sense? Any good operating engineer could have pointed out the fallacy. Superheated steam cannot raise the face temperature of rolls and dryers unless it is thrown away while still hotter than its condensing temperature — the boiling point for that pressure. But that would waste all the latent heat that was absorbed in turning the water into steam. It would be much cheaper to use hot air than to discharge superheated steam.

All steam — saturated or superheated — gives up its heat content by condensing against the metal. Water collects inside the dryer surfaces until it is picked up and discharged through the hollow end shafts. The moisture and metal cannot be any hotter than the boiling point for the steam pressure used. They will, in fact, be slightly below its boiling point because heat flows down hill just like water does, from a higher to a lower level. Some air and non-condensable gas will always collect inside the rolls leaving a thin blanket of fairly pure gas against the metal surface after its steam content has condensed. This insulates and further cools the inside of dryers or rolls the same as in steam radiators, even when care is taken to remove as much of this gas as possible.

Use of superheated steam for faster drying turned out to be a mirage — an expensive failure. Yet the costly experiments were a fitting penalty for superficial study — missing the fixed relation of vapor tension or steam pressure to the temperature of water in direct contact.

Water Vapor In Compressed Air

We have to drain compressed air tanks. Some believe the pressure squeezes water out of the air, like squeezing water out of a sponge. That's wrong.

Suppose the inlet air carries all the water vapor possible. The work done by the machine during compression heats the air so much that it could then carry a great deal more water vapor in the smaller space at that higher temperature. But, as the compressed air cools down in the tank, water condenses steadily to keep its vapor content in balance with its saturation limit for each lower temperature shown in the table above. We repeat, the ability of the air to hold or carry water vapor depends entirely on its temperature at the moment, a certain maximum amount of water vapor for each cubic foot of space, regardless of the pressure of other gases which may occupy the same space.

We call it dry ice because carbon dioxide evaporates without melting. Water can do the same, for it still maintains a small vapor tension below freezing. The vapor tension for 32F is 0.088 — a little more than $^1/_{12}$ psi. Some winter day you may see people skating on paved streets where a thin sheet of ice has formed. The next day or so, still below freezing, the streets are bare because a dry breeze has blown away the vapor as fast as it formed on the ice. In the same way damp laundry can dry thoroughly on a dry, windy, winter day although it is frozen stiff when first hung out.

Several periodicals in this field give problems sent in by subscribers and later print answers from readers. We think too many of these are in the realm of aerial acrobatics, complicated, discouraging to the average reader needing a clear grasp of basic principles. They're like trying to put ornaments on the roof before the foundations are built. We quote one from a contemporary magazine:

How Authoritative Are Experts?

"A steel cylinder is fitted with a piston which is loaded to produce a pressure of 100 psig. The cylinder originally contains one cu ft of 100 per cent quality steam at 100 psig, which corresponds to a temperature of 338 F.

"One cu ft of air at 338 F is now forced into the cylinder, thus producing a total volume of two cu ft of which 50 per cent is air and 50 per cent steam, both at the same temperature of 338 F. The piston will of course rise in the cylinder to accommodate the double volume.

"The cylinder is next surrounded with the water at 70 F and the steam and air cooled until condensation of the steam takes place. At what temperature will the condensation of the steam take place."

Two answers were printed, one by the retired editor, a gentleman of considerable technical standing. Both answers treated it as superheated steam after an equal volume of air had been added at the *same* temperature. The former editor wrote:

"Obviously the steam is superheated; expanding the steam to double its original volume at constant temperature without doing any work results in superheat. The volume of one pound of saturated steam at 114.7 psia is, according to the steam tables, about 3.89 cu ft; doubling the volume makes it 7.78 cu ft.

"Checking the superheated steam tables we find that the volume is 7.843 cu ft for 340 F and a pressure of 59 psia. It is 7.708 for 340 F and 60 psia. Evidently the steam pressure is somewhere between the two figures, which is as close as we can get without a lot of additional mathematics."

Is it possible these prominent men believe the steam is superheated when there is no change of pressure or temperature? In using superheat tables to find when it will condense, is it possible neither of them realizes that superheated steam never does condense? Would they likewise claim that all water vapor in the atmosphere is superheated steam?

A Clear Case of Humidity

The plain fact is, the steam did *not* expand as stated. It has an equal number of air molecules spaced between the steam molecules so it occupies one-half of 2 cu ft, a clear case of 50 per cent humidity in a 338 F — 100-psig atmosphere. Each bit of steam in the mixture occupies only its original volume, being surrounded by air particles at the same pressure which prevent expansion of the steam. It is said to produce one-half the total pressure because that would be its pressure if the steam were allowed to occupy the whole space alone. So we must consider this separate, independent pressure to find out when it will condense. Common steam tables give all required facts.

Half of 114.7 equals 57.3 lb absolute, which is 42.6 lb gage pressure of the steam in the stated mixture, considered as the sole occupant of the total space. As it cools down, some will begin to condense at the condensing point of 42.6 psig saturated steam. It will continue to condense as it cools down, to keep the vapor tension in exact agreement with common steam tables — saturated steam in direct contact with some water — for this change from water to steam and back to water is entirely independent of any other material that may be in the same or surrounding space. The relation is firmly, permanently fixed by Nature and cannot be manipulated by fuzzy theorists.

Learn Facts, But Think, Too

We hope this shows the sharp contrast between learning certain facts and seeing their full significance. Some argument may arise because habits of mind are so powerful and some from those who like to split hairs.

Heat flows from a hotter to a cooler substance. Figures in standard tables give the temperature of the *steam*. Liquid and metal must be very slightly cooler when steam condenses on it. This lower level, called the Wilson line, can change to a named zone, for there should be more difference of temperature for rapid condensation than for the slow change, just as a sharper drop gives faster flow of water. But the small figures have no importance for operating engineers.

We know the ability to analyze can be gradually acquired by practice. There is no substitute for using your own brains when familiar ideas are so persistent. Once a fellow is wide awake and gets interested in this effective method, it turns work into pleasure. We are trying here to show by sample articles the value of closer attention. So, if you want more subjects discussed write the editors of POWER ENGINEERING.

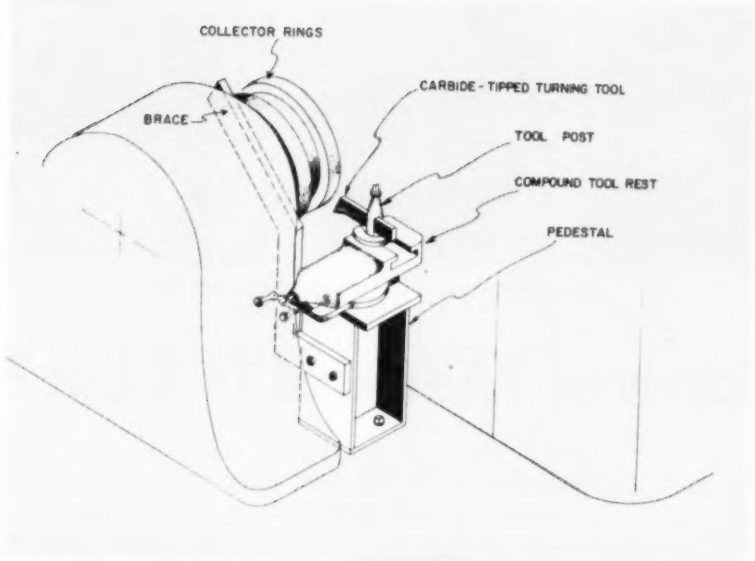


Fig. 1. Perspective view of the collector ring truing rig shows general arrangement of the parts. Note that the carbide-tipped cutting tool is inverted for best results

Method for Truing Collector Rings

By EMIL STUMPP *

USE YOUR HEAD and save your heels is an old adage useful for adults as well as children. This approach to a job task usually pays off handsomely, especially in maintenance procedures. There is always a better, easier way to do a job if you look for it hard enough.

An example of this occurred during the overhaul of a large turbine generator in one of our power plants. The usual procedure for removing brush grooves and truing-up generator collector rings involves a slow and tedious grinding or stoning procedure. This method is based on the use of abrasive blocks clamped to a compound rest which is mounted on a heavy steel pedestal set up adjacent to the collector rings. The turbine generator is rotated at a slow speed while the mechanic applies pressure to the stoning blocks. The time required depends on the condition of the collector rings. It is a slow process at best, and in most cases requires two and one-half to three days. Another disadvantage of this method is that the success of the job is affected by the skill of the mechanic in applying pressure to the blocks.

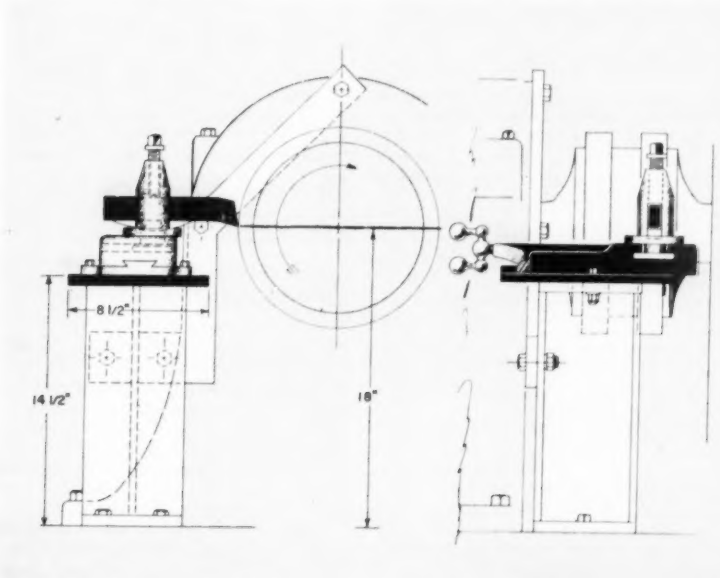


Fig. 2. End and side views of rig for truing up collector rings. The dimensions shown should be altered to suit the particular application and compound rest used

Increases Accuracy

In order to reduce the time required for this work, and to obtain greater accuracy, the following procedure was adopted. A rig was developed to mount a standard cutting tool adjacent to the collector ring assembly, as shown in Fig. 1. The setup consisted of a pedestal, a brace, a compound rest, a standard tool post, and a #78B carbide tipped tool.

The pedestal was made up of a short length of 6-in. H-beam with $\frac{5}{8}$-in. plates welded to the top and bottom. It was bolted to the base plate of the generator. The brace was bolted both to the side of the pedestal and to the outboard bearing housing, using the tapped holes for the brush holder studs. This provided a solid foundation on which was mounted the compound rest. The accuracy of the setup of the rest and tool holder was easily determined by standard alignment procedures, and provided precise lining up of the tool for cutting purposes, as indicated in Fig. 2. This illustration also gives the dimensions of the various parts to fit this particular job. It is recommended, as shown in Fig. 2, that the tool be inverted and applied to the rings slightly above the horizontal centerline so there will be no tendency for the tool to dig in and seriously mar the ring surface.

Quickly Made, Saves Time

After the setup was completed, the turbine operator was stationed at the throttling valve and maintained a machine rpm which provided a suitable speed for cutting. A machinist using this rig turned down and polished the rings to run true within 0.0005-in. The final polishing was accomplished with #150 Aloxite cloth and was performed at a higher speed, approximately 800 rpm. The entire truing operation was completed in less than an hour's time. This procedure, in addition to reducing the actual truing-up time, produced an accuracy which would be difficult to duplicate by the usual methods.

This rig, which can be used on other turbine generator units, was fabricated in approximately one day by one man.

* Mechanical Maintenance Overseer, Forstmann Woolen Co., Passaic, N. J.

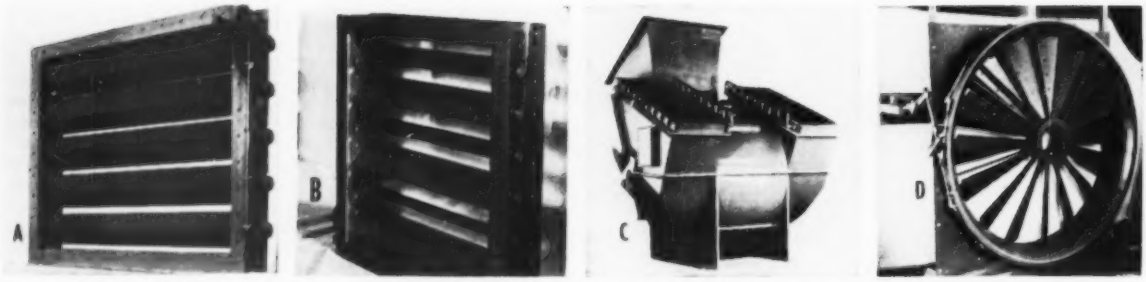


Fig. 1. A. Uni-directional blade louver dampers. B. Reverse-directional blades. C. Uni-directional on inlet boxes. D. Inlet vanes

What Fan Control Method Is Best?

For a fan to meet its requirements, its control is as important as the fan itself. Here are some pros and cons of fan control methods in common use today

By JOHN F. TOBIN *

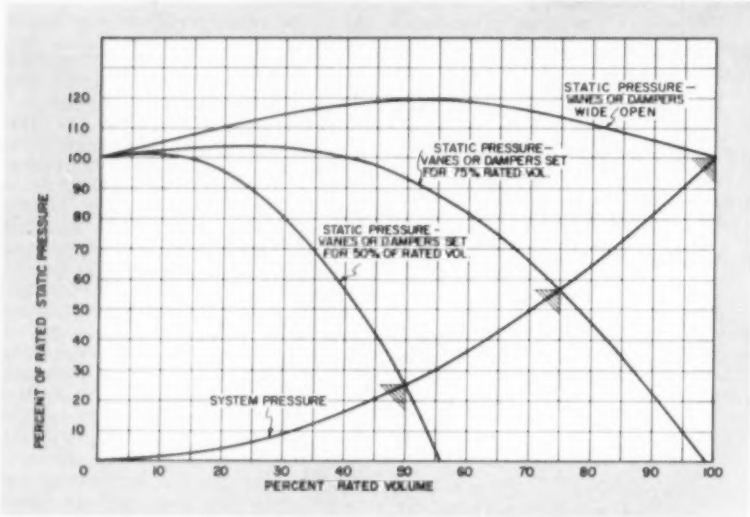

STATIC PRESSURE — VANES OR DAMPERS WIDE OPEN
STATIC PRESSURE — VANES OR DAMPERS SET FOR 75% RATED VOL.
STATIC PRESSURE — VANES OR DAMPERS SET FOR 50% OF RATED VOL.
SYSTEM PRESSURE
PERCENT OF RATED STATIC PRESSURE
PERCENT RATED VOLUME

Fig. 2. Effect of partially closed vanes or dampers on fan pressure-volume curve

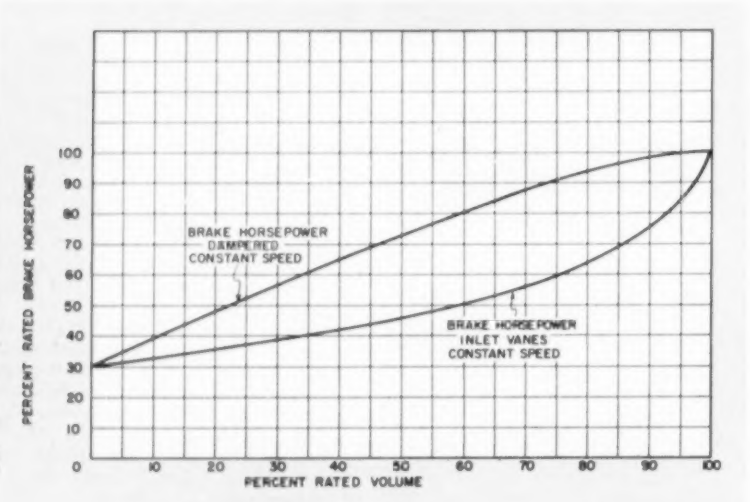

BRAKE HORSEPOWER — DAMPERED — CONSTANT SPEED
BRAKE HORSEPOWER INLET VANES CONSTANT SPEED
PERCENT RATED BRAKE HORSEPOWER
PERCENT RATED VOLUME

Fig. 3. Power-volume relationship when vanes or dampers used for volume control

IN MANY fan installations, such as forced and induced draft fans on boilers, fan capacities must be controlled accurately if the entire process is to function as intended. Assuming correct fan selection with adequate capacity, pressure, and power available, this article will deal with the problem of providing fan output to match the requirements.

Possible methods of volume and pressure control with electric motor drive can be listed in tabular form:

A — Constant speed

- a) — Dampers, louver type
  - 1 — Uni-directional louvers
  - 2 — Reverse-directional louvers
- b) — Inlet vanes

B — Variable speed

- a) — Variable speed motors
- b) — Fluid drives
- c) — Magnetic couplings

Constant speed fans have following:

Advantages: — Lowest first cost; least space required; no inertia problem, once started; quicker response

Disadvantages: — Least efficient; greatest noise; greatest wear; hardest to start

Variable speed fans have following:

Advantages: — Most efficient; least noise; least wear; easiest starting

Disadvantages: — Greater first cost; greater space required; some inertia; slower response

Louver dampers are the simplest type of volume control device and are made in two types. Figure 1 (A)

* Western Division Power Equipment Manager, American Blower Corporation.

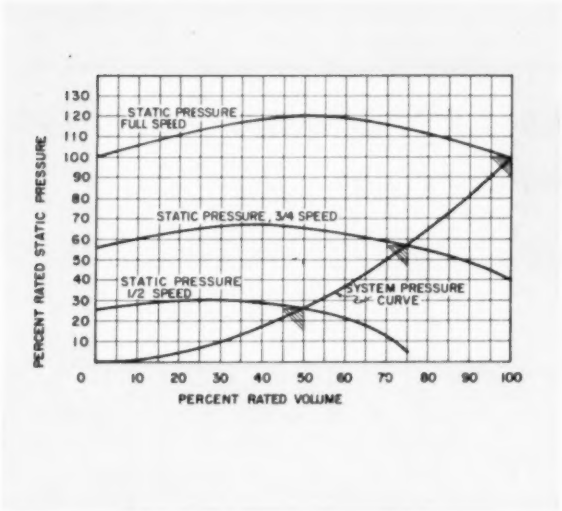


Fig. 4. Effect of variable speed on fan pressure-volume curve

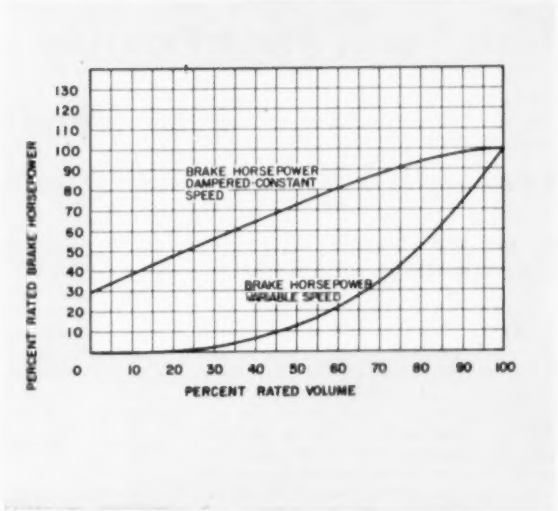


Fig. 5. Power comparison, constant and variable speeds

shows the uni-directional blade type and Fig. 1 (B) the reverse-directional blade type. The latter type is generally preferred because it gives better blade movement control and less down-stream turbulence and duct wear when handling abrasive dust. However, uni-direc ional blade louvers are us d on fans with inlet boxes to reduce fan hp requirements similar to inlet vanes, see Fig. 1 (C), and when used in this position have good relation between blade position and capacity.

Vane and Damper Control

Inlet vanes, Fig. 1 (D), are pie-shaped segments of the fan inlet circle which are pivoted at the center of each segment so that when all are rotated in same direction the air entering the fan is given a spin in direction of the fan wheel rotation, thus reducing the relative speed of the wheel and the air entering it. This cuts the fan capacity in the same manner as dampers, but the hp required is less than with damper control because the residual velocity leaving the vanes, being in the direction of the wheel rotation, helps it deliver work, whereas with dampers the downstream energy is wasted.

Figure 2 illustrates the effect on the pressure-volume curve of a fan when either vanes or dampers are partially closed to reduce the fan output. Figure 3 shows the relation of power requirements when dampers or vanes are used for volume control. The damper power curve is the same as the fan test power curve. Inlet vanes have the same power requirement as dampers at the zero and rated volume points, but at intermediate points show lower values as indicated.

When fans are operated at variable speed the pressure-volume curve shrinks as shown in Fig. 4, the volume dropping directly with speed and the pressure directly with the square of speed. The fan efficiency does not change on a fixed system curve and the flow pattern through the fan is not altered with variable speed operation. Figure 5 shows the fan power requirement at reduced speed and volume as compared with the constant speed dampered power. The variable speed power on a fixed system curve is a cube curve through the rated power point and zero with the power varying directly as the cube of the speed or volume. That is, at half volume and speed the fan will require one-eighth of rated volume power.

Without question variable speed operation is the most efficient control and when easily obtained, as with steam turbine drive, is very frequently employed. With alternating-current motors, variable speed is more complicated but possible with slip-ring design and secondary rheostats, either step type with resistance grids or liquid stepless type with water-cooled electrolyte in three separate tanks. Step-type control requires a supplementary damper for vernier adjustment between each two positions, which complicates the control system.

Variable-Speed Drives

The preferred a-c motor variable speed drive today uses fluid drives or magnetic couplings with either an induction or synchronous motor as shown in Fig. 6. Either is capable of stable stepless speed variation of 5 to 1 on variable torque fan load, which is wide enough so that supplementary damper control is seldom required. Figure 7 shows the fluid drive efficiency curve which is approximately a straight line with volume. Fan power is the same cube curve as in Fig. 5, so the motor hp input to the fluid drive is approximately a square curve, because at half speed the *continued on page 110*

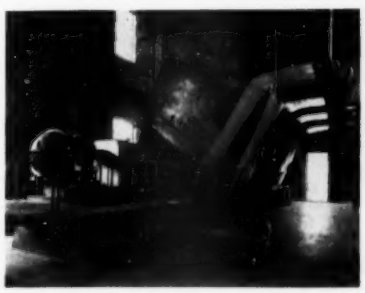


Fig. 6. Example of motor-driven fan in a power plant, the motor driving the fan at variable speed through a fluid drive giving stable stepless speed variation on variable torque fan load

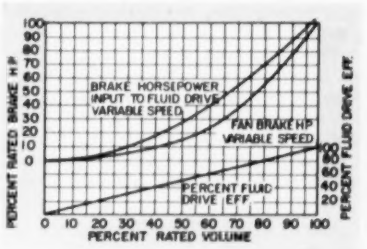

BRAKE HORSEPOWER INPUT TO FLUID DRIVE VARIABLE SPEED
FAN BRAKE HP VARIABLE SPEED
PERCENT FLUID DRIVE EFF
PERCENT RATED BRAKE HP
PERCENT FLUID DRIVE EFF
PERCENT RATED VOLUME

Fig. 7. Horsepower and efficiency curves for variable speed fluid drive

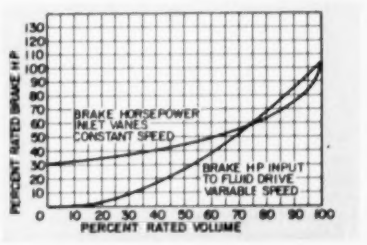

BRAKE HORSEPOWER INLET VANES CONSTANT SPEED
BRAKE HP INPUT TO FLUID DRIVE VARIABLE SPEED
PERCENT RATED BRAKE HP
PERCENT RATED VOLUME

Fig. 8. Comparison of power requirements, constant and variable speed fans

The Process Extraction Turbine

A Review for Old-Timers — A Must for Young-Timers

By WILLIAM H. ENGELMAN *
and HELMUTH W. ENGELMAN †

THE DISTINGUISHING feature of the process extraction turbine is its control system, which not only incorporates a speed governor, but also regulates the pressure at the extraction nozzles. All steam enters the high pressure section of the turbine under control of the speed governor. After doing work in the high pressure section, it reaches the first extraction point, from which it may either leave the turbine through the extraction nozzle or continue through the turbine to do additional work. The pressure at the extraction point is controlled by regulation of the flow to the low pressure end of the turbine. The extraction flow is regulated by process demand, independently of the turbine governing system. As process demand for steam increases, extraction pressure tends to drop, and the pressure control tends to shut off the flow of steam to the low pressure section of the turbine. The loss of work in the low pressure end of the turbine causes the speed governor to admit more throttle steam. In practice, the pressure and speed governors usually are interconnected so that partial compensation of the speed governing system occurs when the pressure governor acts, and vice versa, in order to keep fluctuations of both speed and extraction pressure small.

The *extraction factor* is the increase of throttle flow, in pounds per hour, required to maintain constant shaft power output as the extraction flow is increased one pound per hour.

Quality or superheat of extracted steam varies as the turbine power output and extraction flow change. It is often necessary to determine the actual heating effect available in the extraction steam, and the manner in which this may be done is shown in the following example. Ratings and operating conditions for the turbine are given in Table I.

All figures are for a double extraction turbine. Pressures in the ratings are given in lb per sq in. absolute

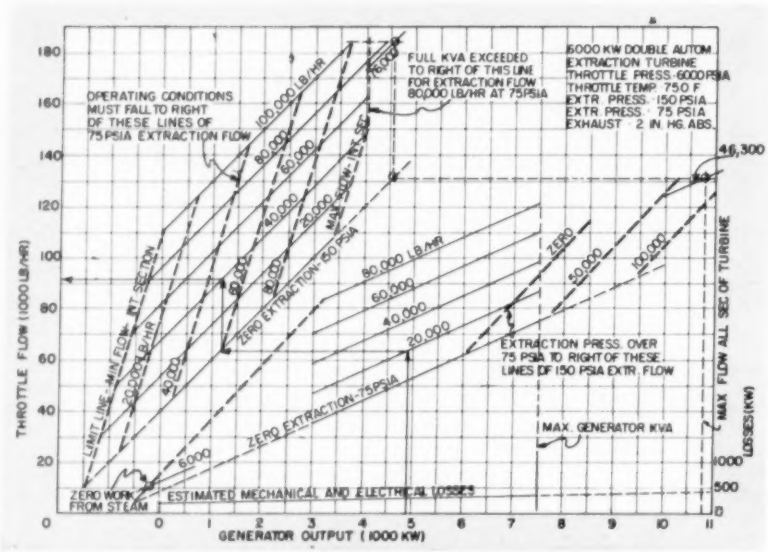


Fig. 1. This extraction chart shows performance of turbine considered in example. Curves extended beyond range normally given to show factor in selection of unit

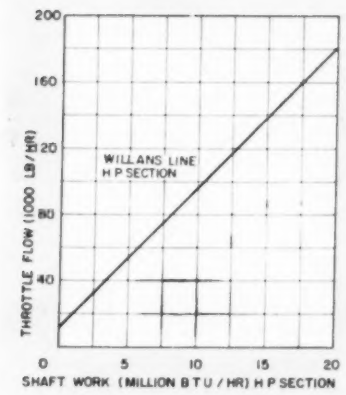
Table I. Operating conditions and ratings of turbine discussed in the text

TURBINE:		
Throttle conditions	600 psia, 750 F	
First extraction	150 psia	
Second extraction	75 psia	
Exhaust	2 in. Hg abs	
Rated output, zero extraction flow	6000 kw	
Flow Limits, lb/hr	*Max.*	*Min.*
High pressure section	184,000	—
Intermediate section	108,000	10,000
Low pressure section	61,700	4,000
GENERATOR: 6000 kw at 0.8 power factor		

* Mechanical Engineer, Cleveland, Ohio.
† Assistant Professor of Mechanical Engineering, The University of Wisconsin. All re-publication rights reserved by the authors.

Table II. Results of calculations for a number of load and extraction flow demands show properties of extracted steam

Generator load, kw	3000	3000	3000	6000	6000	6000
Extraction flow, lb/hr @ 150 psia	0	0	80,000	0	0	80,000
@ 75 psia	0	60,000	0	0	80,000	80,000
Throttle flow, lb/hr	35,200	70,000	91,500	61,700	108,000	164,000
H.P. sec. work, Btu/hr	3,078,500	6,932,500	9,458,750	5,957,250	11,397,500	17,977,500
H.P. sec. work, Btu/lb	87.4	99.0	103.3	96.5	105.6	109.7
150 psia nozzle h, Btu/lb	1292.5	1280.9	1276.6	1283.4	1274.3	1270.2
Supht, F	177	154	147	159	142	135
Equiv. sat. flow factor	1.114	1.101	1.096	1.103	1.093	1.088
Equiv. sat. flow, lb/hr	0	0	87,648	0	0	87,056
Int. sec. flow, lb/hr	35,200	70,000	11,500	61,700	108,000	84,000
Inlet volume, Cu ft/lb	3.95	3.73	3.70	3.75	3.70	3.65
Volume flow, cu ft/hr	139,040	261,100	42,550	288,750	395,900	306,600
Int. sec. work, Btu/lb	34.9	40.6	8.2	41.3	43.0	41.7
75 psia nozzle h, Btu/lb	1257.6	1240.3	1268.4	1242.1	1231.3	1228.5
Supht, F	144	109	166	113	93	86
Equiv. sat. flow factor	1.084	1.065	1.096	1.067	1.055	1.052
Equiv. sat. flow, lb/hr	0	63,870	0	0	84,368	84,120



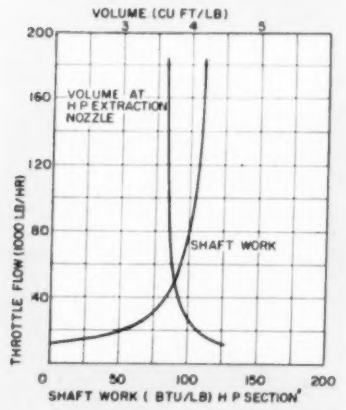
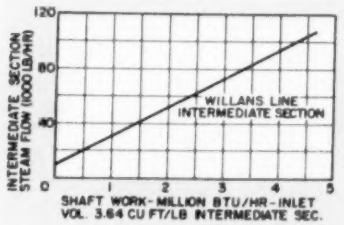


Fig. 2. Upper graph shows Willan's line for high pressure section of turbine. Lower, volume at HP extraction nozzle versus shaft work


WILLANS LINE
INTERMEDIATE SECTION
INTERMEDIATE SECTION STEAM FLOW (1000 LB/HR)
SHAFT WORK- MILLION BTU/HR - INLET VOL. 3.64 CU FT/LB INTERMEDIATE SEC.

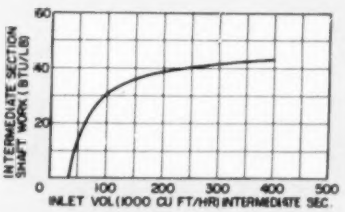


Fig. 3. Willan's line for intermediate section shown above. Below, curve shows approximate work per pound of steam versus volume flow

(psia) to simplify the explanation. Figure 1 shows the performance, or extraction, chart for this machine. The steam flow curves have been extended to maximum flow in all three sections to show that the turbine is actually capable of almost 11,000 kw. The choice of the generator size for this machine indicates that the power and extraction demands are relatively independent.

Curves are plotted in terms of generator output. However, the energy given up by the steam in the form of work also includes mechanical and electrical losses of the turbine and generator. Therefore the estimated losses used in the calculations are plotted on the extraction chart.

The extraction factors are found from the extraction chart (Fig. 1). The throttle steam flow for 6000 kw load without extraction is 61,700 lb. per hr. At the same load, but extracting 100,000 lb per hr at 150 psia, the throttle flow is 131,700 lb per hr, an increase of 70,000 lb per hr. The extraction factor for 150 psia extraction is:

$$\frac{\text{Throttle flow increase}}{\text{Extraction flow}} = \frac{70{,}000 \text{ lb/hr}}{100{,}000 \text{ lb/hr}} = 0.700$$

Similarly, the extraction of 80,000 lb per hr of steam at 75 psia, at a load of 6000 kw, requires that throttle flow be increased from 61,700 lb per hr without extraction to 108,000 lb per hr, an increase of 46,300 lb per hr. Then the extraction factor for 75 psia extraction is:

$$\frac{46{,}300 \text{ lb/hr}}{80{,}000 \text{ lb/hr}} = 0.579.$$

Work done by steam in the turbine can be found from the zero extraction data on the extraction chart. For present purposes, the actual work per pound of steam is of less importance than the *work increment*, which is the increase of shaft power per lb per hr increase of steam flow. With no extraction, 35,100 lb per hr throttle flow produces 3000 kw output plus losses estimated at 250 kw, and 61,700 lb per hr produces 6000 kw plus 300 kw estimated losses. Then the work increment becomes:

$$\frac{\text{Shaft power increase}}{\text{Steam flow increase}} = \frac{3050 \text{ kw} \times 3413 \text{ Btu/kw hr}}{26{,}600 \text{ lb/hr}} = 391.5 \text{ Btu/lb.}$$

This is *not* the work done per pound of steam in the turbine. It is the *change* of work for one lb per hr *change* of throttle flow without extraction.

The work increment for the high pressure section of the turbine is found by use of the extraction factor for the first extraction opening, i.e., 0.700. The change of work in the high pressure section due to a change of flow of one lb per hr is equal to the change produced by 0.300 lb per hr (1.0 − 0.7) change of flow for the entire unit. Since the throttle flow is the sum of the extraction flow and the condenser flow, the condenser flow drops 0.3 lb per hr when the throttle flow is increased 0.7 lb per hr to provide one lb per hr extraction steam.

For the high pressure section, then, the work increment is:

$$(1.00 - 0.70)\ 391.5 \text{ Btu lb} = 0.30 \times 391.5 = 117.5 \text{ Btu lb.}$$

The work increment for the high pressure and intermediate sections together, from the 75 psia extraction factor, is:

$$(1.00 - 0.579) \times 391.5 \text{ Btu/lb} = 0.421 \times 391.5 = 164.8 \text{ Btu lb.}$$

of this, 164.8 − 117.5 = 47.3 Btu per lb is the work increment of the intermediate section alone.

The work increment for the low pressure section of the turbine is then:

$$391.5 - 164.8 = 226.7 \text{ Btu/lb.}$$

The specified minimum flow rate for the intermediate and low pressure sections is sometimes referred to as "cooling steam". In this case, when the flow in the low pressure section is less than the stated minimum of 4000 lb per hr, due to the churning action of the blades, the enthalpy of the steam leaving is higher than that of steam entering the section, and dangerous blade heating may result. At approximately the stated flow of 4000 lb per hr, the steam does no work, and the entering and leaving enthalpies are the same.

These values of minimum flow can be used to determine the flow for zero shaft work in the high pressure section. Assume a load (plus losses) of 6300 kw, and a throttle flow of 61,700 lb per hr without extraction. Now, if the flow in the low pressure section is reduced to 4000 lb per hr, the shaft output is reduced by the flow change multiplied by the work increment of the section, or:

$$(61{,}700 - 4000)\ 226.7 = 57{,}700 \times 226.7 = 13{,}080{,}590 \text{ Btu/hr.}$$

And, for the intermediate section:

$$(61{,}700 - 10{,}000)\ 47.3 = 51{,}700 \times 47.3 = 2{,}445{,}410 \text{ Btu/hr.}$$

Thus, the total work of the low pressure and intermediate sections is the sum of the above, or 15,526,000 Btu per hr. Since *continued on page 106*

Modernized Conveyor System Increases Coal Handling Capacity: — Correction

ABOVE ARTICLE on Page 63, July 1954 issue, should have stated that all the coal handling equipment shown in the photographs was supplied by Gifford-Wood Co.

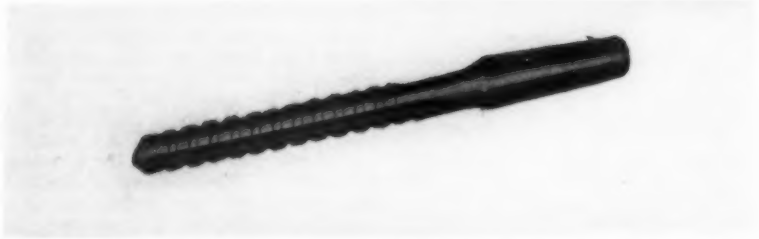


Fig. 1. Example of carbide tip hammer bit whose performance is discussed below

Masonry Drilling . . . Hammer Bits

Advantages of hammer bits, the materials they can drill, and selection of the best bit for each job are all discussed in this article, the last of our present series describing principles and latest developments in masonry drilling and how to select and use equipment

By BERNARD L. CHAPIN* and RALPH H. ALPER†

ELECTRIC HAMMERS are rated on the basis of the diameter hole they will drill with a steel star drill. Unfortunately, the manufacturers of hammers do not specify a standard material or bit as the basis for their rating. As a result, hammers of the same hole diameter rating, but of different manufacture, will give varying results with the same carbide bit in the same material.

Hammer manufacturers' ratings are generally somewhat higher than is actually the case. This is probably because the materials on which they have based their rating are somewhat softer than most materials usually encountered.

This is not to say that a two inch hammer will not drill a two inch hole in a very hard concrete with a steel star drill. However, the recommendations in Fig. 1 take into account the material and the fact that a drilling rate below one inch per min is not satisfactory. It also is a recommendation which will give the best all-round results in greater penetration and bit life. It is not the purpose of this chart to state that a $\frac{1}{2}$ in. hammer cannot drill a $\frac{1}{2}$ in. hole in granite. It is merely an indication that a $1\frac{1}{8}$ in. hammer will do it much faster, and yield far more bit life.

Above $1\frac{1}{4}$ in. in diameter, the *core* type hammer bit is preferable, and these bits are capable of producing good drilling rates up to two inches in the hardest materials, using present largest commercial electric hammers. For larger size holes in such materials, air hammers should be used to maintain good drilling rates under all conditions.

*Executive Vice-President and †Development Engineer, New England Carbide Tool Co.

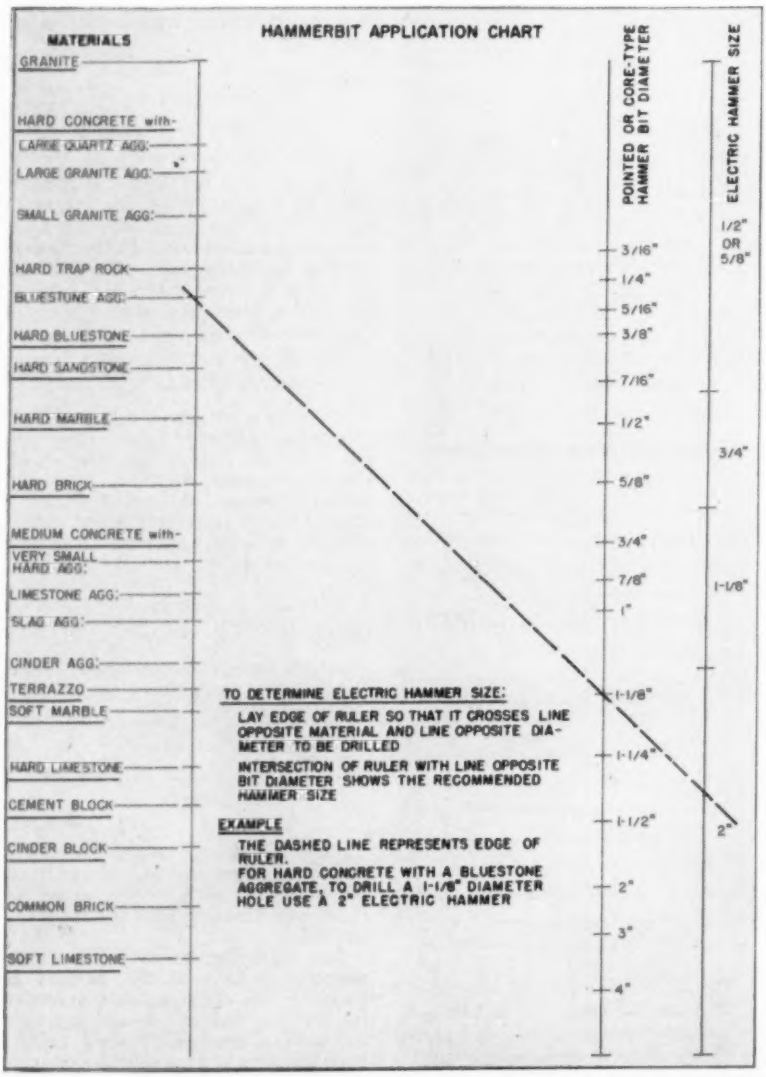


Fig. 2. Chart gives right bit diam and electric drill size for various materials

Electric and air chipping hammers are excellent for drilling holes of all diameters with extremely high efficiency.

Hammer Bits

The range of materials which can be drilled with carbide tipped hammer bits is nearly unlimited. Hardness and abrasiveness have very little effect on hammer bits, and their range extends far beyond that of rotary bits. The only property of masonry materials which need concern the user of hammer bits is brittleness. The design of the bit should take care of free moisture content and bulking properties of the material.

Brittle materials such as vitrified clay products, like tiles, can be drilled with small diameter bits in light electric hammers. Diameters above $^{3}/_{16}$ in. in these materials, even when the material is set into a wall or a floor, should only be drilled by hammer bits if the sections are more than two inches thick in the direction of drilling, and at least two inches in any direction in the plan perpendicular to the direction of drilling.

The most striking fact about carbide hammer bits is their extremely long life. Hundreds of inches of the hardest materials are readily drilled with carbide hammer bits. Once the hammer has been chosen, no outside pressure of any magnitude need be applied. The choice of too small a hammer, however, will result in too much tip wear.

The use of too light a hammer in hard materials will rapidly demonstrate the relatively greater wear, and the use of too large a hammer will place the greatest strain on the shank of the bit and tip.

Some indication of the rate of penetration of hammer bits of various diameters in several materials is shown in Fig. 3.

In actually applying hammer bits to a job, the selection, as stated before, is based on the material and the hole diameter.

If the hole diameter is below $1^{1}/_{4}$ in., even if the material is well within the range for rotary bits, a hammer bit can be used to good advantage. Bit life is many times that of the rotary bit, and drilling rates are, in many cases, as high or higher than that of the rotary bits. It is only in the very softest materials that rotary bits will show decided advantages over hammer bits.

The accuracy of Fig. 2 is limited by the differences between the test materials being drilled, as well as by the discrepancies in the commercial rating of hammers made by different manufacturers.

In predicting bit performance with hammer bits, Fig. 3 can be used if one hole of any diameter is drilled in an unknown concrete. Then the rate of penetration of any size bit can be determined by drawing a line of equal slope to the existing one through the plotted point representing the rate of penetration and diameter of the bit used to test the unknown concrete.

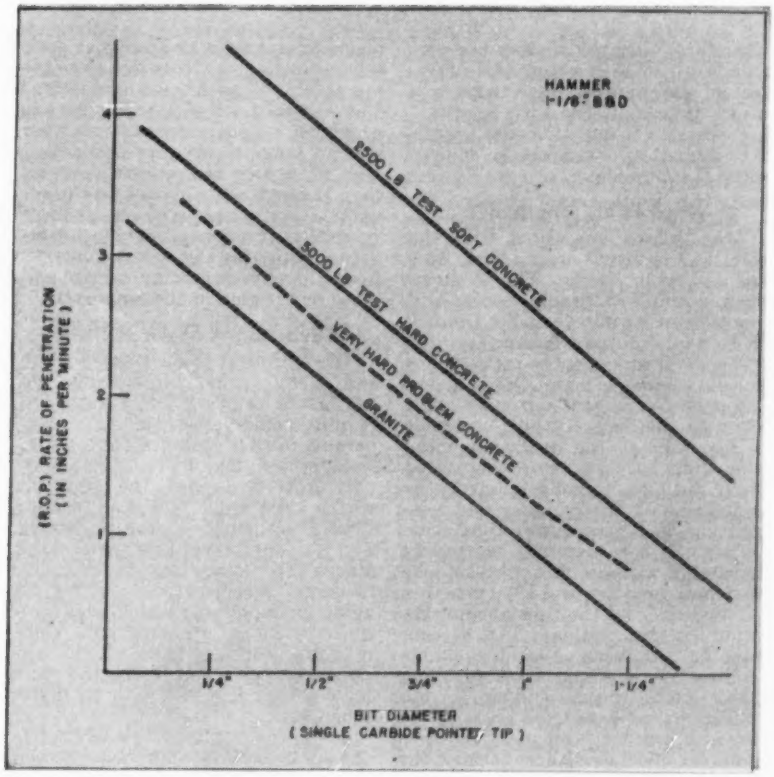


Fig. 3. Chart shows effect of bit diam on penetration rate when drilling concrete

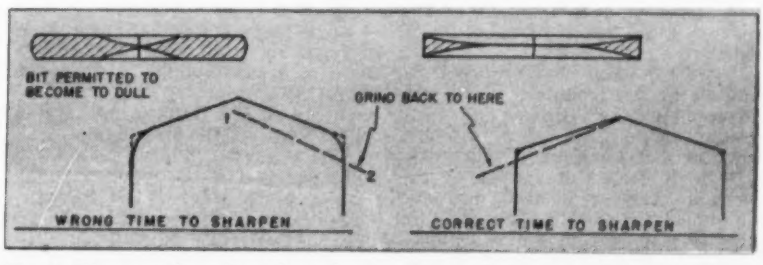


Fig. 4. Diagrams show the right and wrong time to sharpen a carbide tipped tool

Sharpening

A great deal has been said of the importance of sharpening a carbide bit at the correct time. Several reasons for this importance have been given for both rotary and hammer bits. Basically, the duller a tip becomes, the more quickly it continues to dull. Accelerated dulling means first of all that tip breakage will occur suddenly. Secondly, the slight additional hole production per grind gained from using a dull bit can reduce the number of grinds which may eventually be obtained. Figure 4 shows this. Much more carbide must be removed from the bit that has been used too long, than from one which is sharpened on time.

Conclusion

The information which has been presented in these articles on masonry drilling should be considered as a starting point. The wide variety of masonry materials permits nothing more at this time. Each material must be treated as a separate problem, and it is hoped that the foregoing information will at least permit the user of the carbide tipped masonry bits to recognize the direction in which he must go to solve his particular problem.

For full size copies of this bit selection chart and a reprint of this article, write to the Editor, or write HAMMER BITS on one of the prepaid postcards elsewhere in this issue and mail it to us. If you want reprints of the whole series, which began in the June issue, write MASONRY DRILLING on the card.

A new magnetic amplifier, result of recent metallurgical advances, offers real advantages for industrial process control. Responsive and reliable, it has no moving parts that need maintenance

Amplistats in Industry

By M. W. CANNON*

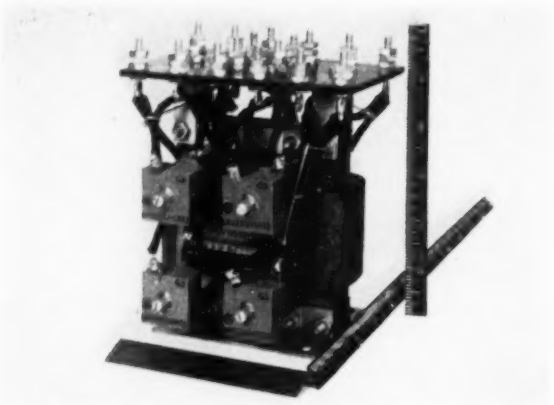


Fig. 1. This is an amplistat. Note simplicity of construction, lack of moving parts, and small size. Available in many ratings

CONTROL regulating systems have been used for a great number of years to regulate various operations in the manufacture of many products. The very early systems used magnetic contactors to control in steps the armature voltage of generators or the field current of motors. Within a few years the carbon stack regulator was developed in order to provide continuous control of regulation in place of step control. However, in the late 1930's, machinery manufacturers wanted their machines to become more versatile in operation. One of the first steps toward this end required a wider range of operation of the manufacturing machines, thereby requiring more range on the control regulating systems. As a result electronic tube amplifiers began to be used with thyratron type tubes in the output stages controlling the generator fields. Electronic amplifiers with their inherent fast operating speed in response to a changing signal permitted the speeding-up of the manufacturing operations considerably. However their inherent disadvantages of limited life of tubes, non-reversing characteristics of the tubes, and the relatively small output power soon prompted the electrical manufacturers to seek something better.

The Amplidyne

It was about this time that the amplidyne was developed. The amplidyne is a two stage rotating amplifier with reversible high output power. This development was a major step in the forward advancement of fast, wide range reversible regulating systems. As a result the speed and installed horsepower used on a large number of manufacturing processes was greatly increased. However, the amplidyne is still a rotating machine with the attendant maintenance of bearing, brushes and commutators. Therefore, after the close of the second World War a great deal of research was done in order to perfect a new type amplifier with no rotating parts. The result is the amplistat, Fig. 1, a new device to supplement the amplidyne.

What Is an Amplistat?

Most people connected with the electrical industry are familiar with the saturable reactor. Fig. 2 shows such a simple saturable reactor and the type of output available from it. With no d-c current flowing through the control windings the reactance of the a-c winding is high thereby allowing only a very small current to flow through the load. As the d-c current is increased in the control winding the iron becomes more saturated with d-c flux, thereby reducing the reactance of the winding and permitting a larger current to flow. When the core becomes completely saturated with d-c flux the reactance becomes very low and the current is limited only by the resistance of the windings and the load. This type of reactor has been used for simple control systems and for controlling the lights in theatre and similar applications for 30 or more years. However, it has not been used for more complex control systems because the d-c control ampere turns must equal the a-c ampere turns and therefore very little gain is attained in the reactor if fast speed of operation is desired.

After the close of World War II United States technical teams discovered that the Germans had made great progress in the use of magnetic amplifiers utilizing high grade steels. The high degree of success of the German engineers in using magnetic amplifiers provided the incentive for new development work in the United States on high permeability steels. Fig. 3 shows the simple bridge type magnetic amplifier or amplistat with self-saturating rectifiers and the output obtainable with this combination. The self-saturating rectifiers permit a gain of output ampere turns over control ampere turns by permitting load current to flow in one direction only through the a-c coils on the reactor. Greatly improved metals have permitted the saturation of the reactors with less and less d-c current flow thereby providing more and more power gain in the amplistat.

Advantages of Amplistats

The amplistat is completely static and therefore has no bearings, no brushes or rotating commutators to require maintenance. Its life is comparable to that obtained from power transformers and metallic rectifiers.

If properly applied, the amplistat will require much less maintenance than a comparable rotating amplifier. If selenium rectifiers are used the stacks will require periodic cleaning. Selenium rectifiers also exhibit an aging characteristic which would require eventual replacement. Germanium rectifiers have as yet displayed no aging and should therefore have a very long life with no maintenance.

In power ratings below 500 watts the amplistat is faster in response and has higher gain than the amplidyne. In power ratings above 500 watts the amplidyne is faster in response than a single stage amplistat; however, if a small 15 to 40 watt amplistat is used as a preamplifier to drive the larger size amplistat this combination will also be faster in response in operation than the amplidyne.

The amplistat reduces installation time and cost of the regulating control systems since it is normally mounted and wired together with the

* Industry Control Dept., General Electric Co., Schenectady, N. Y.

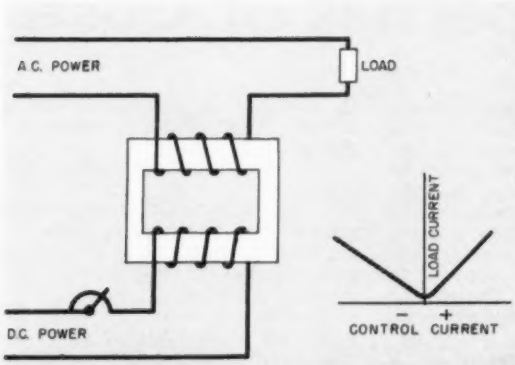


Fig. 2. Diagram showing principle of operation of a simple saturable rector. Small d-c current controls large a-c load

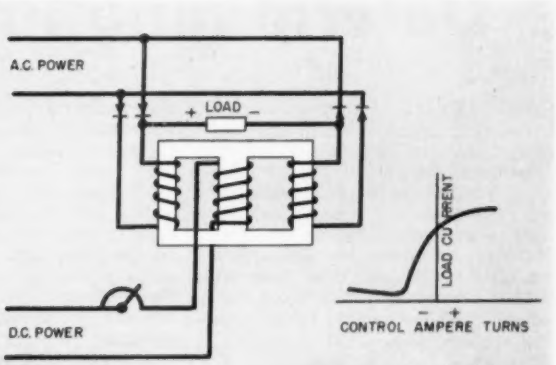


Fig. 3. Simple diagram of bridge type amplistat. Modern magnetic steels permit large amplification with fast response

remainder of the control components. Thus, the purchaser will have less interconnecting wires to run, no a-c motor starters to mount and wire in, and no mg set lineup problems.

The amplistat can be built in a wide range of ratings varying from 1 volt amp. or smaller up to large kw power ratings. However, the amplistat is not a panacea. It has several disadvantages that may limit or prohibit its application to various types of control.

Disadvantages of Amplistats

Current can flow through a magnetic amplifier in one direction only and therefore a single unit cannot be used when full reversing is required. When reversing is required and a single load must be used, such as a generator field, a large power loss is encountered. Several circuits have been developed to permit this type of operation, but the efficiency of even the best circuit is very low compared to a rotating amplifier. The efficiency will vary from about 17 per cent when 2 magnetic amplifiers are used to drive a single reversible load, up to 50 per cent when 4 units are used in a special circuit. This means under the worst conditions that 12 kw of amplifier power would produce 1 kw of useful power. In some applications this may not be economically feasible, and it would therefore be better to apply a rotating amplifier.

The output of the magnetic amplifier is more susceptible to voltage and frequency variation of the main power supply than a rotating mg set. If the application is very critical, special precautions must be taken such as voltage stabilizing transformers, separate supply completely regulated, or more gain must be built into the regulator in order to reduce the effects of these variations.

Some applications require a small amount of reverse d-c excitation in order to reduce or eliminate generator residual voltage. This can be obtained easily by connecting the generator field to a d-c bus through proper resistance such that a small amount of reverse current will flow through the generator field. However, the rectifiers are connected in such a direction that the current flow from the d-c bus will also go through the rectifiers. The net result is that the kilowatt rating of the amplistat unit must be increased to compensate for this current flow from the d-c bus. The most straightforward way of obtaining generator negative excitation involves the use of a separate small percentage field winding. However, this method often increases the physical size of the generator. The economics of the situation will dictate which method should be used. To obtain only 10 per cent negative excitation, the magnetic amplifier kw rating must be increased 50 per cent. Certain other circuits will also permit the same operation and therefore must be very carefully considered.

Extra design care must be given to the application of magnetic amplifiers to highly inductive loads such as large generator fields. When the load is resistive, or only very slightly inductive, proper operation is obtained. However, when the load has an inductive time constant from $\frac{L}{R}$ = to $\frac{1}{2}$ cycle of the power supply frequency to 0.1 second, misoperation of the control may result unless special precautions are incorporated. When resistive loads are used the amplifier is designed so that the changes in fluxes linking the control windings cancel one another. Under inductive loads these flux changes do not cancel one another and a resultant double frequency voltage appears on the control windings. If the resistance or impedance of the control winding circuit is low so that a large double frequency current is allowed to circulate an effect called "snapping" will result. Snapping is a loss of control of the regulating signal over a portion of the characteristic curve of the amplifier. This misoperation can be corrected rather simply by increasing the impedance or resistance in the control circuit. Resistance can be added, or in case a low resistance circuit is necessary, a small external inductor can be added.

It is more difficult to remove a magnetic amplifier from one installed system and apply it to a new system. Some customers with large engineering staffs like to modernize or rearrange their drives as their manufacturing requirements change. This is normally very simple to do if a rotating amplifier is used. However, if a customer did not consider some of these less known characteristics of magnetic amplifiers he might find himself in real difficulty if he applied his available magnetic amplifiers to the newly revised system. The magnetic amplifier may be designed and constructed in any one of several different forms and the design may have a decided effect on the operation of the control regulator.

Future

The amplistat is a new engineering tool that is assuming its proper place in industry for an increasing number of applications. This does not mean that all other means of amplification are obsolete. Carbon pile regulators, electronic regulators and rotating amplifiers all have their place in industry. They all have their advantages and disadvantages and for each application there is one type of amplifier that will be the best one for that particular job. Properly designed and applied, industry has many applications which can utilize each type of regulator to its fullest advantage.

Determining Properties of Gases

PROPERTIES of many gases, and vapors under certain circumstances, can be determined by application of the perfect gas law. This article presents a graphic generalization of this law which has validity in those cases covered by the law itself. Graphical solutions for gas properties take much less time than calculated solutions, and in most cases are sufficiently accurate for all practical applications.

Basic Assumption

As is often done in expressing gas relations, the gas constant, R, for the various gases appearing on the graph has been assumed equal to 1544/M.W. Here, M.W. denotes the molecular weight of the gas in question. The constant, 1544, applies when the other units are feet, pounds, and degrees Fahrenheit (Absolute).

Tables of characteristic gas constants reveal that the maximum error (assuming the above relation between the molecular weight and the gas constant) is no more than 3 per cent when applied to the heavier gases used industrially. For carbon dioxide, the error is considerably less than one per cent, and for the common air and combustion-gas constituents the error vanishes.

Actually, a more severe limitation is imposed upon the graphical solution in trying to apply it to gases under high pressures where the perfect gas relationship does not hold true. Another condition, not noted on the chart, is the two-phase or saturation region common to most gases for particular pressure-temperature regions. Familiarity with the respective gas properties and continual watchfulness should be sufficient to prevent such erroneous applications of the perfect gas law or of this construction. Water and all refrigerants commonly pass in and out of the two-phase region during some part of commercially-successful cycles. This general statement should guide you in using this chart.

Selection of the pair of logarithmic coordinates in making the construction makes it possible to extend the approximate solution indefinitely into regions of higher or lower pressures. One merely needs to be careful to compensate for the change in scale value for the specific volume and density whenever a change is made in the scale value for pressure. The density will change in proportion to the change in pressure. The specific volume will change inversely with pressure.

Range of temperatures, −100 F to 3000 F, is believed adequate to encompass the ordinary applications lending themselves to this method of solution. Another time-saving advantage of this construction over numerical calculation is that there need be no regard for the conversion of temperature to absolute or Rankine values. Also, the conversion of pressure to pounds per square foot is done for you. However, the usual concern about correction of gage pressures to absolute values must be exercised.

The Density Reference Line, sloping upward to the left between temperature values of 500 F and 600 F, is useful in obtaining density from pressure and temperature data. Ignore this line if you desire solutions only for the specific volume along the scale at the top.

A check of steam table values suggests that the graphical solution presented here is entirely suitable for the determination of the properties of moderately to highly superheated steam, whenever the pressure is less than 100 psia. Approximate solutions are given for other less favorable regions of application, with the accuracy increasing with decreasing pressure and with increasing superheat. The accuracy is quite suitable for handling superheated water vapor in its usual range of partial pressures in the atmosphere and for determining its properties in high vacuums. Applications for the above often arise in air conditioning calculations and for steam condenser calculations, respectively.

Again, please note the warning that care should be taken not to apply the chart in instances involving either a liquid or the two-phase region of the substance.

Typical solutions proceed as follows:

(1) Enter the chart along the lower scale at the point corresponding to the absolute pressure of the gas or some power of 10 times the absolute pressure of the gas.

(2) Proceed vertically until intersecting the line sloping up to the right which corresponds to the gas in the problem to be solved. If the gas in your problem is not indicated, draw in the desired line by interpolating between the given molecular weights which bracket the molecular weight of your gas.

(3) Move right, or left, until the temperature line is intersected.

(4) Move vertically to the top scale where the specific volume may be read for the particular gas at the prescribed pressure and temperature.

(5) Or, turn left enroute and read the density along the upper left-hand scale for the particular gas at the prescribed pressure and temperature.

Examples

Data for examples (1) through (5) are given in the table, and the examples (1), (3) and (5) are worked out on the accompanying graphical construction. Try working out examples (2) and (4) to obtain answers corresponding to those given in the table.

Examples (1) and (2) are offered for your comparison inasmuch as the pressure did not change while the temperature was taken for 530 R (70 F) and 1060 R (600 F), respectively. Doubling the absolute temperature with the pressure constant halves the density and doubles the specific volume.

Examples (3), (4), and (5) may be checked approximately with steam tables.

Example (5) illustrates the manner in which pressures beyond the apparent range of the chart can be accommodated. In this case, the chart is entered with one per cent of the actual pressure and specific volume and density are obtained (for 10 psia). To get the true answer, divide the specific volume by 100 or multiply the density by 100. For pressures beyond the lower end of the scale, enter with a multiple of the actual pressure and then *multiply* the specific volume and *divide* the density by that multiple.

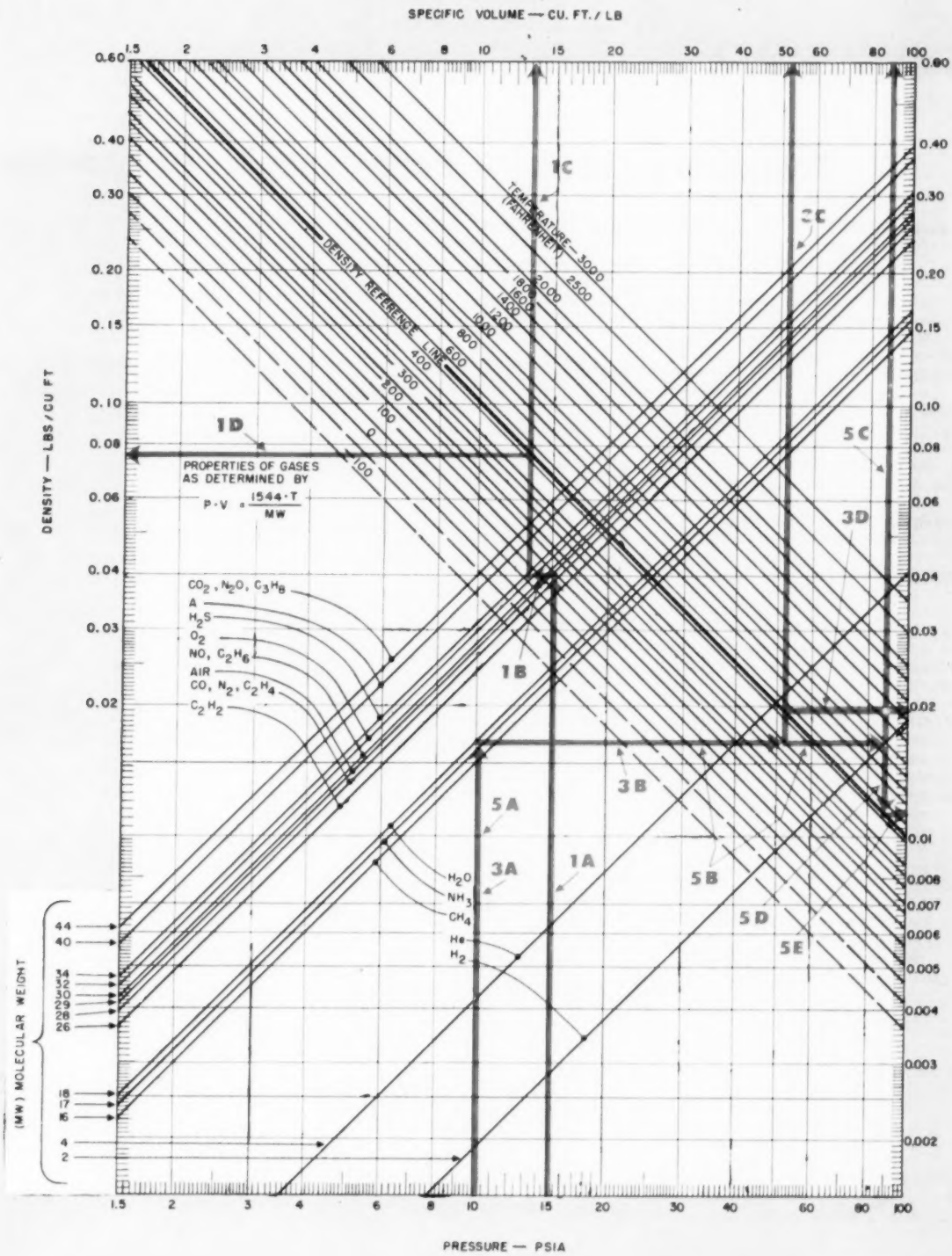
Table of data and results of examples solved graphically (construction, page 91)

Example	Gas	Pressure (psia)	Temperature (deg F)	Specific Volume (cu ft per lb)	Density (lb/cu ft)
1	Air	15.0	70	13.1	0.076
2	Air	15.0	600	26.2	0.038
3	H_2O*	10.0	400	51.2	0.0195
4	H_2O*	100.0	400	5.12	0.195
5	H_2O*	1000.0	1000	0.87	1.15

* Specific volume and density values obtained here for water vapor are approximate and are better determined with the superheated steam tables.

* Chairman, Department of Engineering, and Director of Engineering Institutes, University Extension Division, University of Wisconsin. All republication rights reserved by the author.

Properties of Gases



PRACTICAL ENGINEER and ELECTRICIAN SECTION

Temporary Conveyor Roller Speeds Maintenance

By F. E. RILEY

CONVEYOR belt rollers can be repaired without stopping the belt if a temporary roller similar to that shown in the illustrations is made up. The temporary roller is fitted quickly in a position, adjacent to the damaged one, and acts as a substitute, preventing the belt from sagging while the damaged roller is removed.

Construction of the temporary roller may have to be varied to suit the type of side member in the existing conveyor belt installation, but as the angle-iron sides shown are fairly common throughout coal handling installations, the roller is of fairly universal application

Backbone of the temporary roller is a piece of thick-walled steel tubing and this is fixed to the conveyor side members by means of bent strip steel clips. One of the clips is adjustable on the backbone by means of the strip steel loop which can be clamped to the tube by means of the bolt running through its open ends. Between the open ends the clip is arranged to swivel out of position in order to assist quick and convenient attachment to the conveyor frame members.

A swivel mounting is provided for the clip at the other end of the backbone by drilling a hole horizontally across the tubing diameter and inserting a pin which is riveted over at both ends. A clamp plate is fitted to the second clip for locking it to the conveyor frame member. Clamping pressure is applied by means of the nut welded to the clamp. A bolt passing through both clamp and clip engages with the nut. The clamp plate is prevented from turning during the tightening of the bolt by means of a pair of lugs welded on to its lower end for engagement with the sides of the clip. To avoid losing the bolt it is attached, loosely, to the clip by means of a chain (not shown in sketch).

The roller which supports the conveyor belt during repairs is a tubular member with ball races enclosed in each end running on stationary stub spindles protruding from the ends. The stub spindles are bolted to a pair of threaded uprights, which are turned from hexagon-section bar so that a standard wrench may be used for easy assembly and adjustment.

Height adjustment is provided for the roller by threading the uprights which pass through vertical holes drilled through the backbone diameter and have hexagon nuts at each side, as shown in accompanying Fig. 2.

This temporary roller is used extensively by the maintenance crew of the Midland Electricity Board generating station at Walsall, England. It can be fitted in a few seconds.

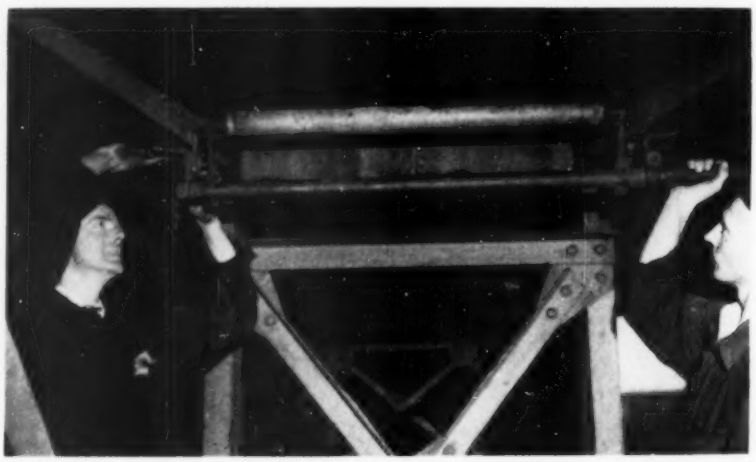


Fig. 1. Workmen install a temporary roller assembly on a conveyor serving an English power plant. As soon as the temporary unit lifts the belt clear, the old unit may be removed without stopping the conveyor. Mounting takes only seconds

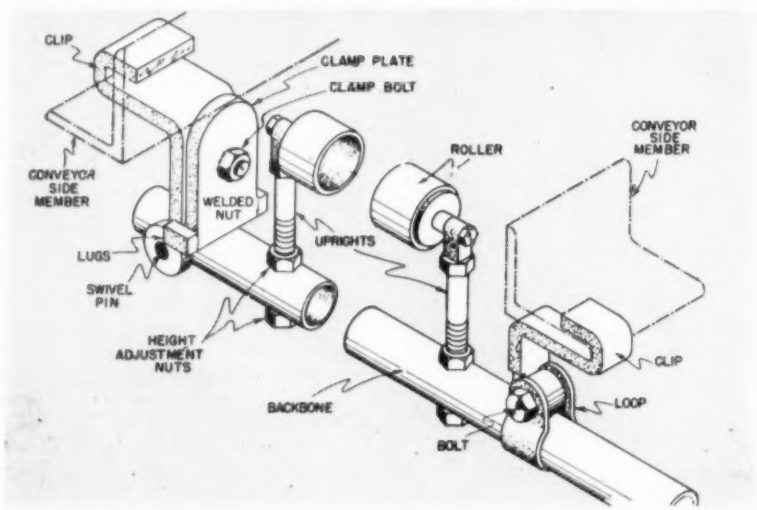
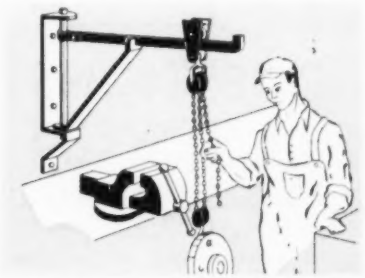


Fig. 2. Details of the temporary roller assembly. Dimensions are not given since they will be determined by the specific application the roller is designed for. The left-hand clip is the clamping member; the right clip merely supports its end

Easily-Made Vise Crane

By CHAS. H. WILLEY

AN EASILY-MADE bench jib-crane equipped with a small chain fall and fastened to the wall near a heavy duty vise enables one man to manipulate large, heavy work in and out of the vise without danger of strain or injury. The drawing shows such a handling crane devised and built by our maintenance crew.



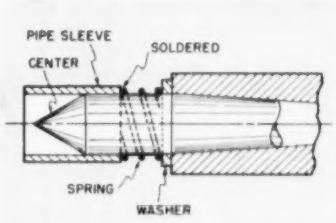
The crane illustrated is a blacksmith's job, but the simplicity of its design makes it an equally easy project for the welding shop.

Accident-Proof Lathe Center

MAKING A PLANT safe involves many things less spectacular than the setting up of bomb shelters and fire fighting teams. The item reported here is a prime example of that truism.

Maintenance department machinists frequently report to the first aid stations for repairs to damage done their elbows and related anatomy by sharp lathe centers. These injuries can be quite painful, but they are unnecessary.

One machinist tired of his sharp encounters with the lathe center and fabricated a shield which, though it protected against accidents, does not interfere with the mounting of work in the lathe. This safety device is shown in the sketch. His first step was to machine down a straight section on the center, over which he could slip a short piece of pipe. A compression type spring was soldered to one end of the pipe as shown. The



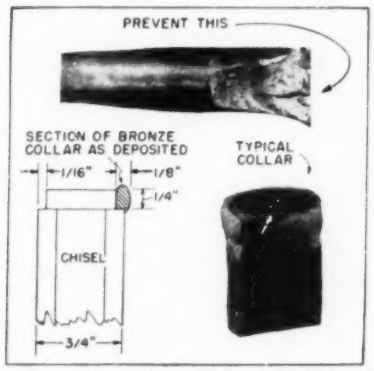
Lathe tailstock with a safetied center

assembly is preceded by a washer onto the lathe center; purpose of the washer is to reduce wear on the tailstock.

Dimensions must be determined for the lathe and the center to which the sleeve will be applied. Be sure to allow enough travel of the sleeve to permit bottoming the center in the work center.

Build Up Safe Chisel Collars

CHISELS, PUNCHES, and star drills subjected to repeated heavy pounding soon become mushroomed at the head, and the embrittled metal lips that have been hammered out are all potential bullets — projectiles which may fly off under continued usage and do serious injury to anyone in the vicinity. All such tools should receive frequent attention and be dressed down on the grinder as necessary.



Pictures by National Safety Council

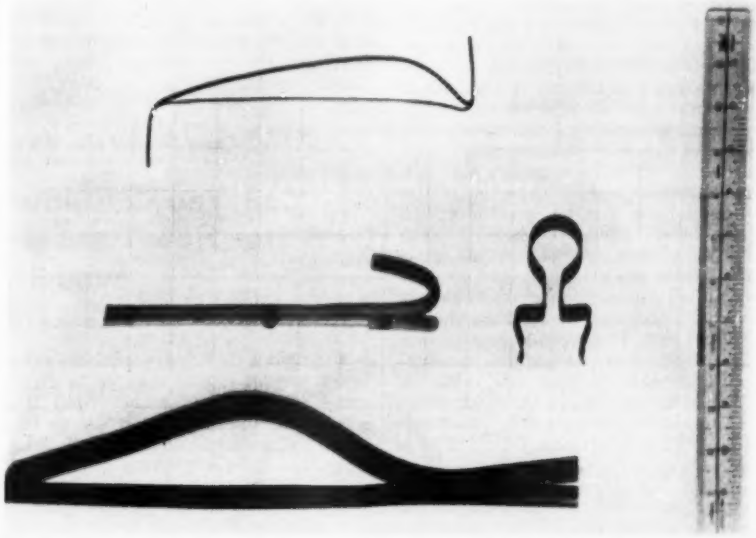
Upper photo shows what can happen to a chisel. Below, details of safety collar

The National Safety Council has an even better remedy — on all tools that take a pounding in doing their jobs, cut or grind a shoulder at the head and fill it with a substantial collar of bronze brazed into place. The illustration shows how. Dress the head flat and your chisel will really take a beating with safety.

Shadowgraphs Replace Pipe Templates and Drawings

BY JOHN J. O'BRIEN

SMALL DIAMETER pipes for conveying fuel and lubricants are usually bent to odd shapes which must be recorded for future use by means of drawings. To assist manufacture, a template bent up from rod is made with reference to the pipe drawing. If the pipes vary considerably in shape, as they do in firms who make special vehicles and frequently change the piping layouts, the storage of drawing and bending templates becomes a major problem. In the plant of one engine builder, the stored drawings and templates were occupying a large amount of space, because a spares service was in



Shadowgraph of piping and clamp replaces fabrication drawings. Squares on the background are used for scaling—are much more distinct in 8 x 10-in. photograph

operation for units up to 15 years old.

Drawings and templates have been eliminated in this plant by the adoption of a simple photographic trick which enables the pipe shape to be recorded in two planes without resort to drafting. An example of a typical piping shadowgraph is shown in the photograph, where it will be seen that the pipe shape plan is clearly shown together with a shadow of its side view.

It is common practice to bend the fuel and oil pipes for a new engine by bend-and-try methods, and then to hand this pipe over to the draftsman for a drawing of it. With the shadowgraph method, the suitably bent pipe is laid on a flat board to which is pinned a sheet of squared paper, calibrated in inches and eighths. The camera is placed directly above the board with the center line of the lens at 90 degrees to its surface. A single light source is used and can be placed at 45 degrees to the board surface with the result that a pipe bend standing, say, 2 in. above the board surface will cast a horizontal shadow for a distance of 2 in. For instance, it can be seen that the pipe at the lower edge of the photograph has a bend 2 in. high, as indicated by the inch squares marked on the paper.

An ideal light source for casting sharp shadows is a focusing spotlight projecting a parallel light beam. The photograph shown, however, was lit by a diffused light source, comprising a 500-watt incandescent lamp in a square shade. By revolving the light source around and watching the shadows, it is possible to project these sharply with such a light source.

Proper Lighting

When setting up the light and the board, an object of known height is stood on the board and the lighting adjusted until its shadow is cast sharply to intersect the appropriate line marked on the board's paper sheet. The photographic set up must be in a darkened room so that other ghost shadows are eliminated.

Prints measuring a maximum of 8 by 10 in. constitute compact pipe drawings which are easily filed. In fact, prints one-eighth the size of the original board area photographed have been found suitable for shop use. When the pipes are set up, suitable labels are attached (not shown) with the part numbers marked clearly so that these can be read on the reduced print. Further information on the label covers the gage, material and diameter of the pipe, also its straight length before bending.

Some care is required in interpreting the shadowgraphs, but it is usually clear to the user after a little practice. In the particular factory which has adopted this method, no records of the pipes other than the shadowgraphs are kept, and it is found that pipes bent to them need little or no adjustment.

An indication of further uses to which such photographs may be put is shown by the metal clip on the right. The shape and size of this is clearly shown together with a $\frac{3}{8}$-in. wide shadow showing that the material is $\frac{3}{8}$-in. strip. The transparent rule on the right is useful in counting up whole inches and can be used as a basis for checking off dimensions with sharp-pointed dividers for more accurate interpretations of shadows.

A piece of transparent plastic piping shown in the photograph can be seen to cast a distinct and clear shadow. It is best to lay a straight part of the component in line with one of the lines on the base paper, as has been done in the case of the capillary tube in the upper left of the illustration. Modeling clay can be used to hold the specimens in place on the board and a piece of this can be seen supporting the pipe.

QUESTIONS AND ANSWERS

Question No. 524

Can a Boiler Make HW for Heating and Steam Simultaneously?

THAT ARTICLE on the use of high-pressure and high-temperature water to heat the Marine Training Base, published in your March issue, was extremely practical and interesting to me. (H-T Water Gives Low-Cost Heat at Twenty-nine Palms — POWER ENGINEERING, March, 1954.)

Will you kindly tell me where and how I may obtain more detailed information on similar installations? (Editor's note: — We have referred the reader to additional sources of information on this subject.)

Now here is something I would like very much to know: Can a boiler be used to generate hot water for such a heating system and simultaneously to generate steam for other uses?

Pennsylvania — J. W. W.

Answer to No. 521

Can You Calculate Water Flow Through Funnel?

Calculate the Tailpipe—Shroff

I BELIEVE G. P.'s greater headache is the correct size of tailpipe to carry away the overflow rather than the size of the funnel. For calculating the correct size of tailpipe, the following data should be known:

1. Maximum [expected] flow of water through the tailpipe.

2. The static head available; i.e. the vertical height of the funnel above the water level in the collecting tank or drain line.

3. The total length of the funnel and tailpipe. This total length equals the actual straight length of piping plus the equivalent length of the fittings. This equivalent length of the pipe fittings can be obtained from any handbook on hydraulics (e.g. *Cameron Hydraulic Data*, published by the Ingersoll-Rand Company).

Now it is merely a question of balancing the static head against the friction losses in the tailpipe and the velocity head. Assume a pipe diameter and read off the friction resistance for the total pipe length, at the maximum flow rate, in feet of water from the handbook. Add to it the entrance and exit losses and the losses due to contraction from the funnel to the tailpipe (also available in the handbook). Add to this the velocity head obtained from the handbook.

The sum of all these (friction resistance + entrance and exit losses + losses due to contraction + velocity head) in feet of water must be less than the static head for the water to flow through the funnel and tailpipe. If the sum is larger than the static head available, the pipe size selected is too small and [all] the water will not flow through it. Hence, repeat the calculations till the correct pipe size is selected so that the sum of the resistances is just a bit smaller than the available static head. For safety and to take care of contingencies, the next larger pipe size may be used.

The same method can be followed for liquids of different viscosities. By looking under appropriate tables, the friction resistance for liquids of different viscosities are easily determined for various flow rates and different pipe sizes. The rest of the calculation is similar to that given for water.

Normally, a 60-deg funnel fitted to the tailpipe will be ample.

H. P. SHROFF

Mithapur, Kathiawar, India

continued on page 96

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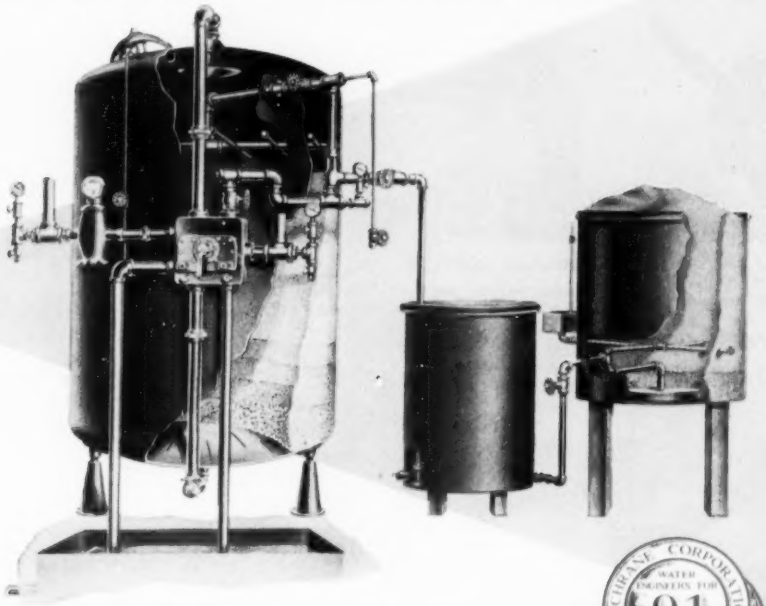

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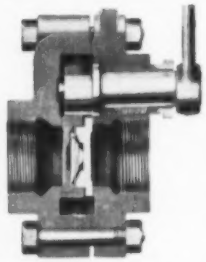

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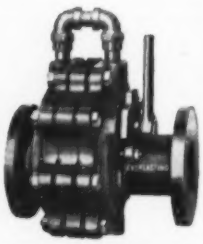

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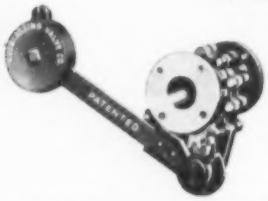
Assure continued free flow of any material which congeals at ordinary temperatures.



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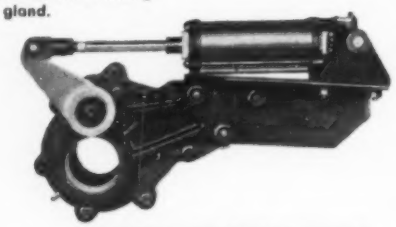

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QUESTIONS AND ANSWERS

continued from page 94

Question No. 525

Double-Crank Uniflow Steam Engine

RECENTLY a friend of mine mentioned an unusual type of uniflow steam engine which he had seen referred to in some book or magazine some time ago. But he cannot now remember where he saw it, nor can he find any reference to it. I wonder if any POWER ENGINEERING readers have ever come across the unusual engine he describes.

He says it is a standard uniflow engine cylinder with a single piston rod connected to two crossheads — one on either side of the rod. From each crosshead runs a connecting rod, connected at the other end to a crank and its crankshaft. But these connecting rods and cranks are so arranged that the cranks turn in opposite directions as the two crossheads stroke back and forth. In other words, one crank runs "over" while the other runs "under." One of the cranks and its crankshaft drive the armature of a generator. The other crankshaft drives the field of the generator in the opposite direction. That is, both the field and the armature of the generator revolve, but in opposite directions.

Now I understand from the electrical engineers that such a generator is perfectly feasible and has been known for a long time, and that its principle is used in the super-synchronous motor. I am told there are not very many of these motors actually operating, but that they can be built if desired. The advantage claimed for the super-synchronous motor is that you get a relatively high speed between armature and field of the generator or motor though each one is rotating at half the relative speed. I also understand there are certain advantages in the control of the two elements.

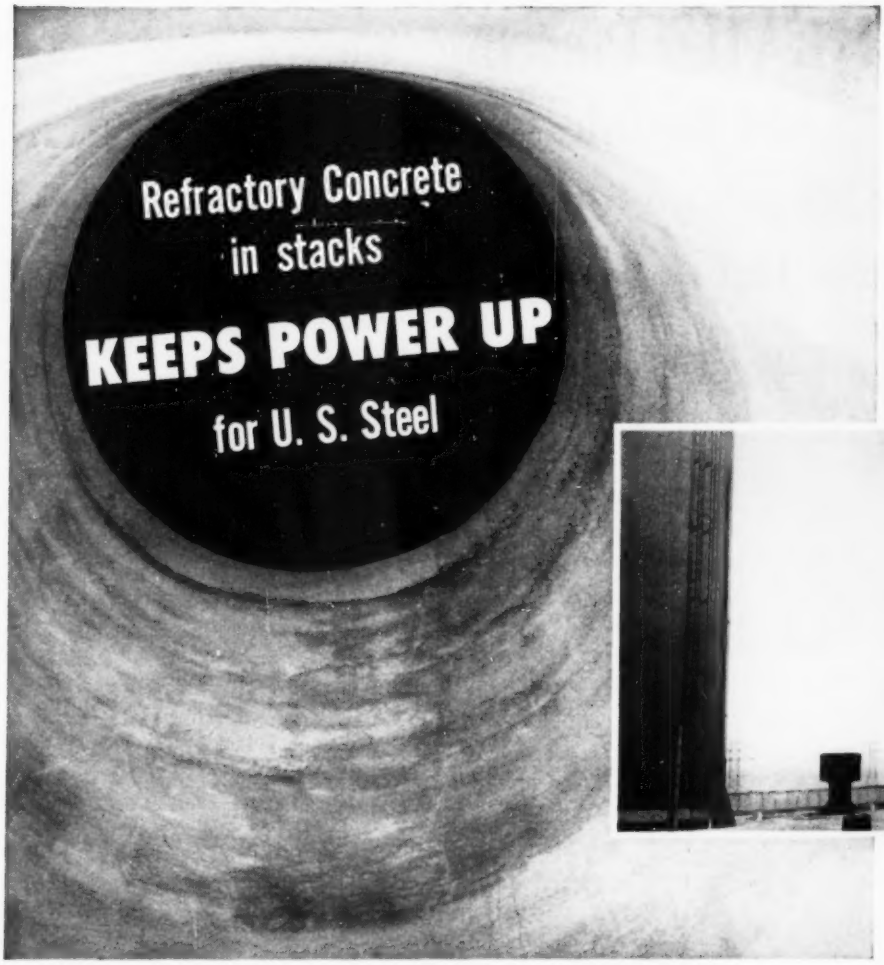
If such a uniflow engine with the two-directional cranks has ever been used with such a two-directional generator, I would like to find out about it. I think it would fit an unusual condition that we are investigating in our plant.

So, if any Q. & A. reader has ever seen or heard of anything like this or knows where one of them has been described, I shall be deeply grateful if he will send me any information he has about it.

Chicago, Illinois D. V. T.

Unique Cable for Kitimat

KEMANO HYDRO-ELECTRIC power station, which will supply energy to the Kitimat Aluminum Reduction Works 450 miles northwest of Van-



FAST WORK—Each 14′ 10″ i.d. x 61′ 6″ high stack got a 2½″ lining of Refractory Concrete in just 4 days after reinforcing wire mesh was attached. Concrete made with Lumnite Cement and traprock was "shot" on by cement gun.

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FOR CONVENIENCE, you may prefer to make Refractory Concrete with prepared castables (Lumnite Cement plus aggregates selected for specific temperature and insulation service—add only water). They're made by refractory manufacturers and sold through their dealers. For more information, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

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continued from page 96

couver (see June, page 84), will make use of a unique 301 kv all aluminum oil-filled power transmission cable for the first time in the world, the Summer and Pacific General Meeting of the American Institute of Electrical Engineers was told.

The 2,000 foot cable, which will carry power from underground transformers to outside transmission lines, was described by H. D. Short, Canada Wire & Cable Company, Toronto, and J. T. Madill, Aluminum Company of Canada, Ltd., Montreal, in a paper presented at an insulated conductors session.

The cable, having an all aluminum conductor and an aluminum sheath "is therefore, in this respect alone, of a design unique in high voltage practice," the authors said. "It will be appreciated that this latter design represents an innovation in extra high voltage cable engineering, being the first commercial use of an all-aluminum h.v. cable in the world as well as the first cable system of its rating designed in its entirety in the British Commonwealth or North America. It records an achievement in Canadian engineering, and the first cable having an operating rating over 161 kv designed, developed and manufactured in North America."

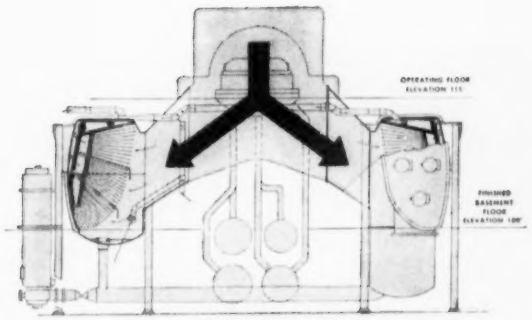
Soviet Electric Power

RECENT ISSUES of Russian technical publications indicate that the Soviet electric power industry is making rapid strides in equipping its installations with modern machinery. According to an article in *Planovoe Khoziaistro* (*Planned Economy*), No. I, 1953, "the most important technical achievement in Soviet electric power stations is the application of steam at high pressure (90 atmospheres or about 1280 psi) and high temperatures (up to 932 F), which makes possible a 12 per cent reduction in fuel outlay. The power of electric power stations using high pressure now comprises 27.2 per cent of the power of all steam power stations in the U.S.S.R. and is 18 times higher than the prewar level. As a rule, during the Fifth Five-Year Plan, high-pressure boilers and turbines will be installed in the large electric power stations." As our readers know, such types of equipment have been in common use in the United States for many years.

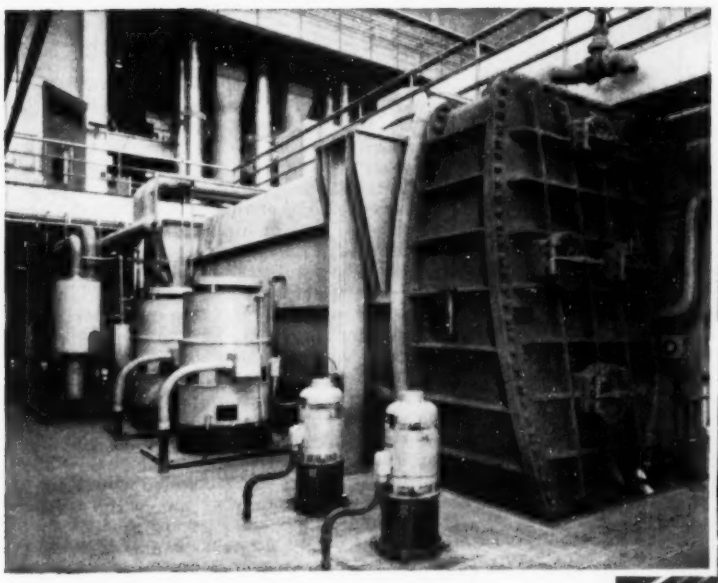
Amount of fuel necessary to produce a kilowatt-hour of electricity is claimed to have been reduced in Russia from 1,060 grams in 1913 to 596 grams in 1940 and 539 grams in 1950. There is said to have been a further reduction in 1951–52. This is equivalent to 1.19 lb, almost identical to the United States average of 1.18 pounds in 1949. The best U. S. plants, of course, now use about 1 lb of coal per kilowatt-hour.

new angle

in turbine-exhaust-condenser arrangement

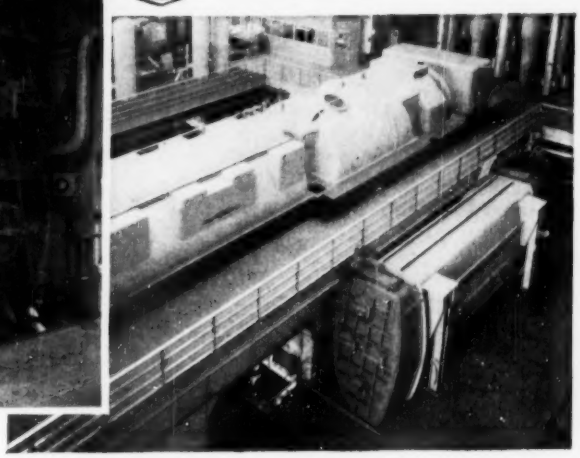


saves headroom and construction costs at Kearny Generating Station



One of the FW side-mounted condenser shells from basement level, showing deflection columns, condensate pumps and heater drain pumps.

General view of turbine room at Kearny station, showing one of the twin condenser shells and the side-exhaust turbine.



The slightly unorthodox surface condenser illustrated above is one of two 70,000 sq. ft. side-turbine-exhaust units designed and built by Foster Wheeler for Public Service Electric and Gas Company, N. J. Serving a 145,000 kw turbo generator at the new Kearny Generating Station, it has effected important overall economies in station construction.

Total height from basement level to turbine operating level is only 15 feet. This low height was achieved without appreciable increase in turbine discharge path, which feeds directly into the twin single-pass condenser shells through a short divided exhaust piece. Careful studies showed that the reduction in headroom was a definite economic advantage. The space below the exhaust piece is effectively utilized by four feedwater heaters.

Each half of the condenser shell is suspended from four deflection columns which allow for thermal expansion without the customary expansion joint or spring arrangement.

Specializing in the design and construction of steam generators, surface condensers and feedwater heaters, Foster Wheeler is fully equipped, engineering and productionwise, to meet your requirements for the modern steam plant. For further information write for HE-3-54. Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.

FOSTER WHEELER

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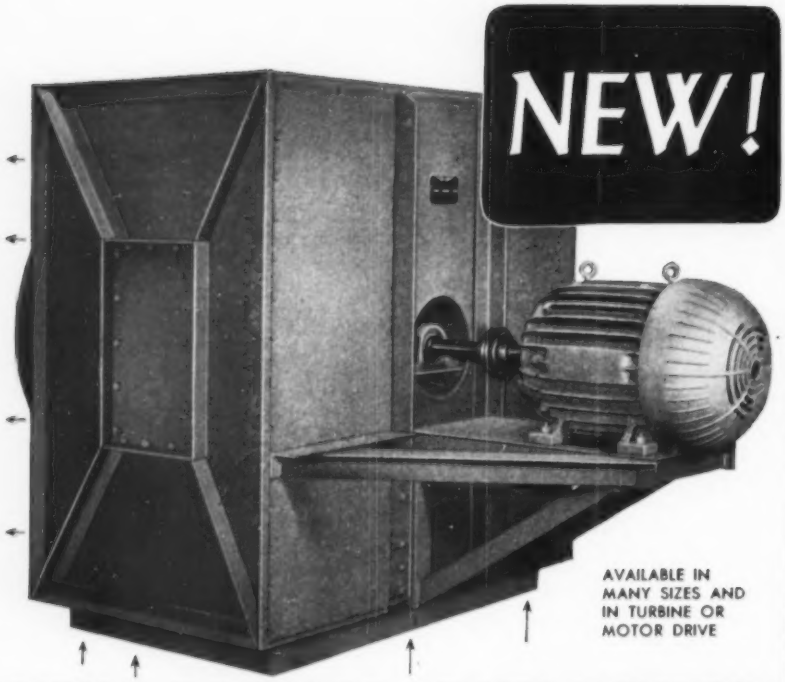

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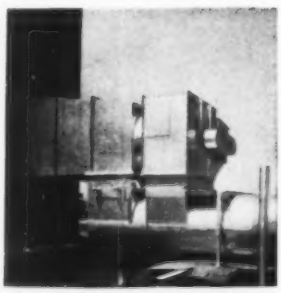

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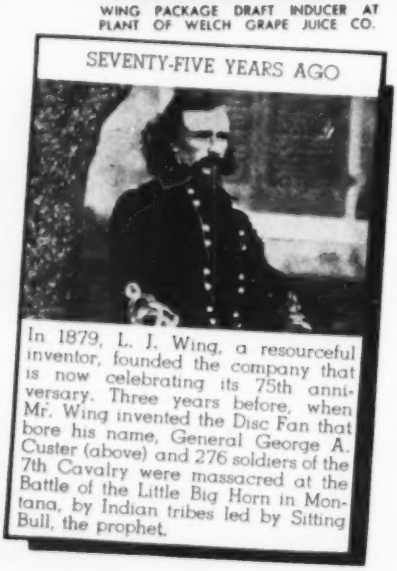

In 1879, L. J. Wing, a resourceful inventor, founded the company that is now celebrating its 75th anniversary. Three years before, when Mr. Wing invented the Disc Fan that bore his name, General George A. Custer (above) and 276 soldiers of the 7th Cavalry were massacred at the Battle of the Little Big Horn in Montana, by Indian tribes led by Sitting Bull, the prophet.

OUR 75TH YEAR 1879

Wing

For more data circle 550 on Post Card

continued from page 78

minimum torque. When it is up to speed, the compressed air pressure will be gradually decreased, allowing the water to rise into the runner and the motor to begin developing shut-off power. Then the butterfly valve will be opened and the unit will pump water to Carter Lake.

Flatiron pump-turbine has been designed for best efficiency as a pump rather than as a turbine because its primary function is to store water in Carter Lake Reservoir for the irrigation system. Its efficiency as a turbine will be 2 or 3 points lower than as a pump. Primary purpose of the entire system is to supply irrigation water when it is called for, and that will not necessarily be at a time when the pump-turbine could generate high-value peak-load electric power.

Operation of the Flatiron unit will be somewhat different from that of a true pumped-storage unit. In pumped-storage applications, the objective is to pump into storage during periods of low electric load demand or during off-peak periods when the electric power cost is low. Then, at electric peak load periods, the water is available to generate electricity for sale at a higher rate.

The Flatiron unit, however, is to be used primarily as a pump to store irrigation water.

Flatiron Power and Pumping Plant was designed by the Bureau of Reclamation engineers. The pump-turbine unit was designed by coöperation between those engineers and Allis-Chalmers Mfg. Company, and was built and installed by the latter. For the Bureau, I. A. Winter is chief, hydraulic machinery branch, with headquarters at Denver, Colorado. For Allis-Chalmers, the pump-turbine unit was the special responsibility of Frank A. Jaski, assistant chief engineer, engineering group, Hydraulics Section, Power Department.

L. N. McClellan is assistant commissioner and chief engineer of the Bureau of Reclamation, Denver, Colorado. Carl Gates is engineer, mechanical design for the Bureau, with G. H. Johnson as his assistant. These two men played important parts in design and construction of the pump-turbine unit. G. J. Hornsby, test engineer for the Bureau, was in charge of the pump and turbine tests on the unit. W. L. Clark is superintendent of Flatiron and Pole Hill.

Salt-velocity tests on the pump-turbine, noted above, were conducted by Leslie J. Hooper, professor of hydraulic engineering and director of Alden Hydraulic Laboratory, Worcester Polytechnic Institute, D. E. Cannon office engineer, South Platte River District, Bureau of Reclamation, supplied photos for Figs. 1 and 2. To all these men, we are indebted for data and for heartiest coöperation when we visited the Flatiron plant.

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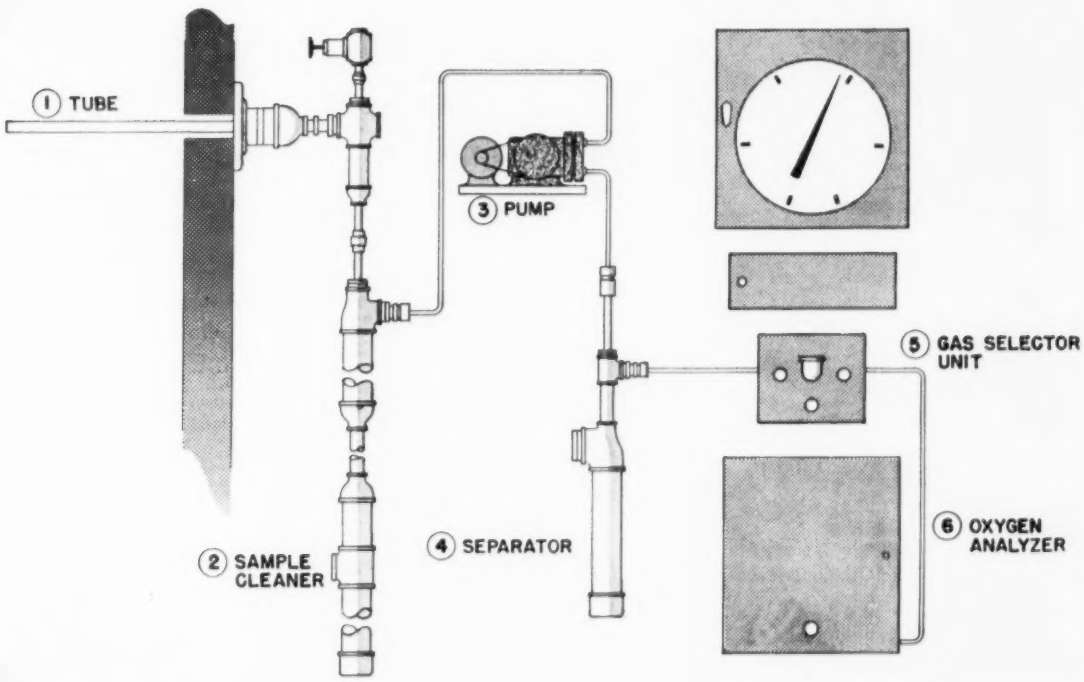

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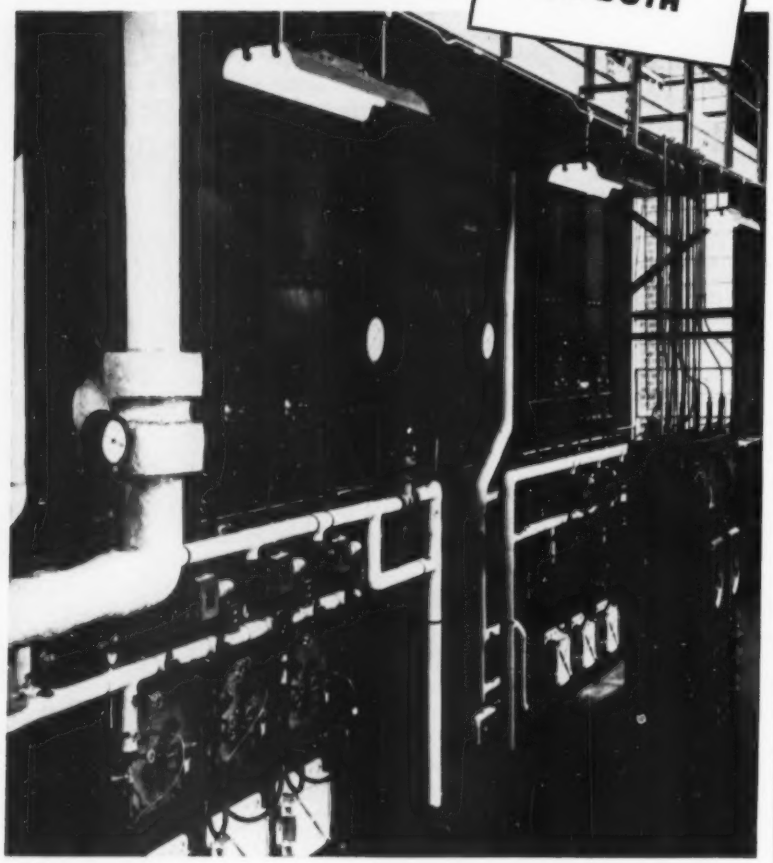

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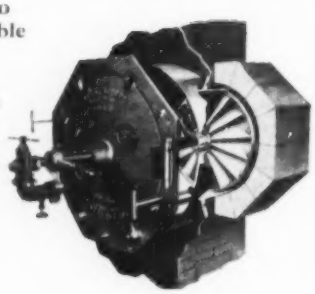

Enco type K oil burning unit

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Pick the Right Piping

continued from page 71

uninstalled is about as good a criterion of relative costs, including installation costs, as is available, since all pipe considered for this job is seamless tubing. Current prices are listed in Table III. Because it is the lowest, the price of carbon steel pipe is the base and is rated as 1.000. This base price is then compared in per

Table IV. Material creep rating values

THE CREEP RATING 1.) Determined from the allowable stress at temperature. Allowable stress "S" from Table 1. 2.) The value 1.000 is assigned to the highest "S" allowable. 3.) All other "S" allowances are rated in percent against this value as shown below:		
Material	S Allowable Psi	Creep Rating
A-53, Gr. B	7,800	$^{7800}/_{14400} = 0.542$
A-106, Gr. B	7,800	0.542
A-335, P-1	13,150	$^{13150}/_{14100} = 0.913$
A-335, P-2	13,150	0.913
A-335, P-12	14,200	$^{14200}/_{14400} = 0.986$
A-335, P-11	14,400	1.000
A-335, P-22	14,400	1.000
A-213, TP-321	14,300	$^{14300}/_{15400} = 0.993$
A-213, TP-347	14,300	0.993

cent against the remaining prices to obtain the total cost ratings for all the materials listed in Table II.

The Final Choice

The four ratings in Table II foreach pipe material are now totalled. The theoretical maximum total can be 4000. To present the total ratings as a percentage of this maximum they

Table V. Ductility for each material

THE DUCTILITY RATING A matter of low alloy additions, including carbon limitation, to control: 1.) Graphitization in ferritic steels, 2.) Chrome-embrittlement in austenitic steels.				
Ferritic Steels	Silicon Killed?	Carbon less than 0.20%?	Chrome 1% or over?	Total Ductility Rating
A-53, Gr. B	Yes	Yes	No Cr	0.667
A-106, Gr. B	Yes	Yes	No Cr	0.667
A-335, Gr. P-1	Yes	Yes	No Cr	0.667
A-335, P-2	Yes	Yes	Only .5% .166	0.833
A-335, P-12	Yes	Yes	Only .8% .266	0.933
A-335, P-11	Yes	Yes	Yes	1.000
A-335, P-22	Yes	Yes	Yes	1.000
Austenitic Steels	Carbon Less than .15%?	Ti or Cb Stabilized?	Total Ductility Rating	
A-213, TP-321	Yes	Yes	1.000	
A-213, TP-347	Yes	Yes	1.000	

continued on page 105

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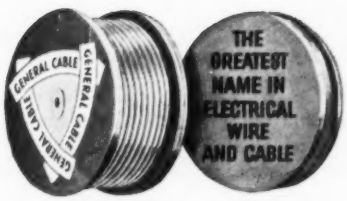

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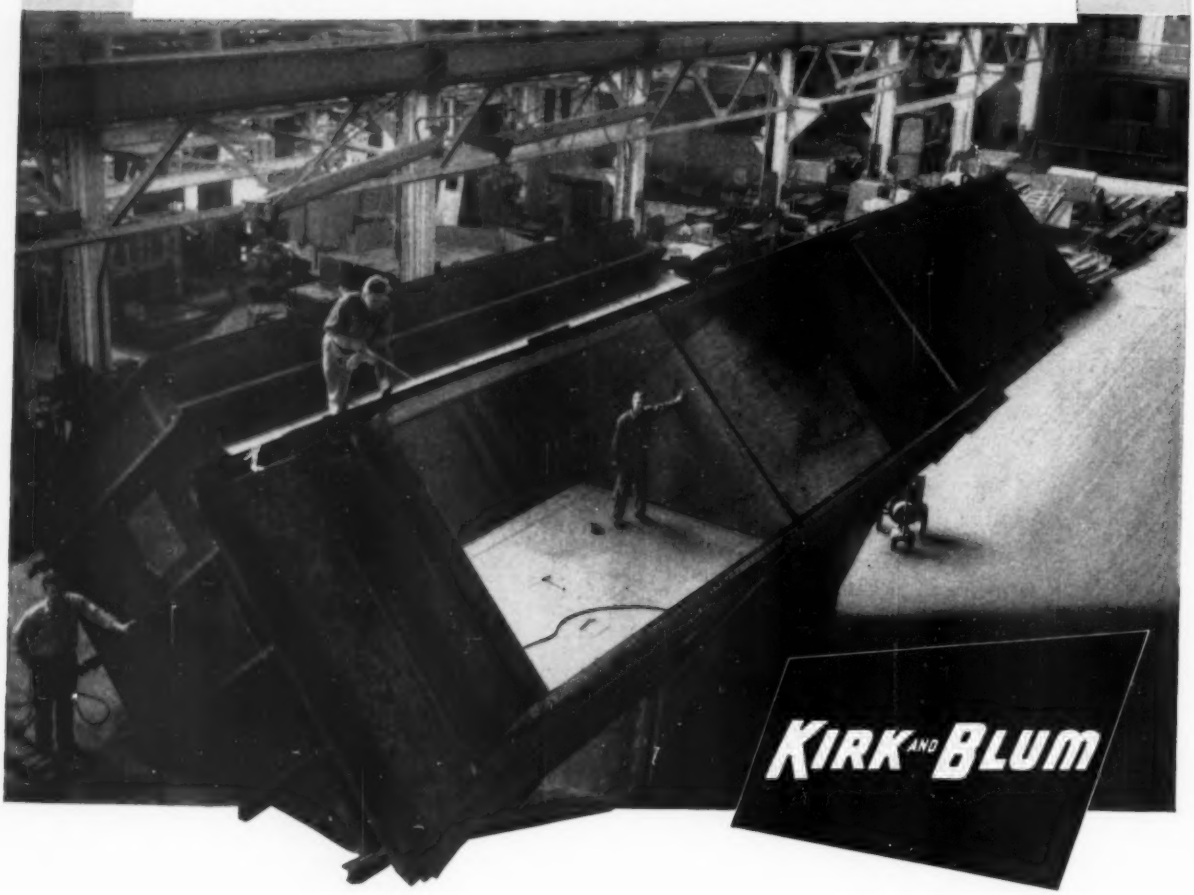

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Pick the Right Piping

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are averaged. The material with the highest average rating is then the choice for this service, in this case the medium chrome-moly steel ASTM A335-P11. The curve shows quite clearly the advantageous rating of this material over the others. Obviously the austenitic stainless steels were priced out of the picture, while the plain carbon steels' low physical properties at elevated temperatures placed them at a disadvantage.

Specifying and purchasing the pipe is not the complete job in a system subjected to the above steam conditions. The care in selecting and ordering the correct pipe material can be completely nullified by incorrect welding procedure. In particular the weld metal (the welding rod) must be of the same or similar composition to the base or pipe metal (*). Any deviation from this rule should not be made without study. The same general rule applies to welding end valves, flanges, or other piping to which the above material might be welded.

There is little point in going to the trouble and expense of selecting the correct material for piping, valves, and flanges, and then using incorrect material for welding, or otherwise making weak welded joints so that the strength of the right piping and fittings is wasted.

Table VI. List of flexibility ratings

THE FLEXIBILITY RATING

$$\text{Flex. Rating} = f\left(\frac{1}{E}\;\frac{1}{I}\;\frac{1}{e}\;\frac{1}{t}\right)$$

Assign the rating 0.25 to the lowest value of each of the above four characteristics as listed in Table 3. The other values in each case are rated in percent against this lowest value.

Material	Rating E	I	e	t	Total Flexibility
A-53, Gr. B	0.228	0.149	0.246	0.136	0.759
A-106, Gr. B	0.228	0.149	0.246	0.136	0.759
A-335, P-1	0.228	0.204	0.246	0.198	0.876
A-335, P-2	0.228	0.204	0.249	0.198	0.879
A-335, P-12	0.228	0.204	0.250	0.198	0.880
A-335, P-11	0.228	0.250	0.250	0.250	0.978
A-335, P-22	0.228	0.250	0.250	0.250	0.978
A-213, TP 321	0.247	0.250	0.188	0.250	0.935
A-213, TP 347	0.250	0.250	0.188	0.250	0.938

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   Iron Age, Vol. 166, No. 9, August 31, 1950, P. 64-68

continued on page 106

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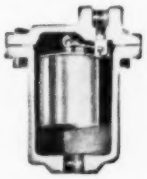

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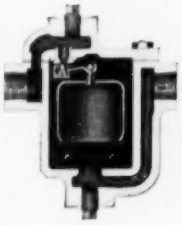

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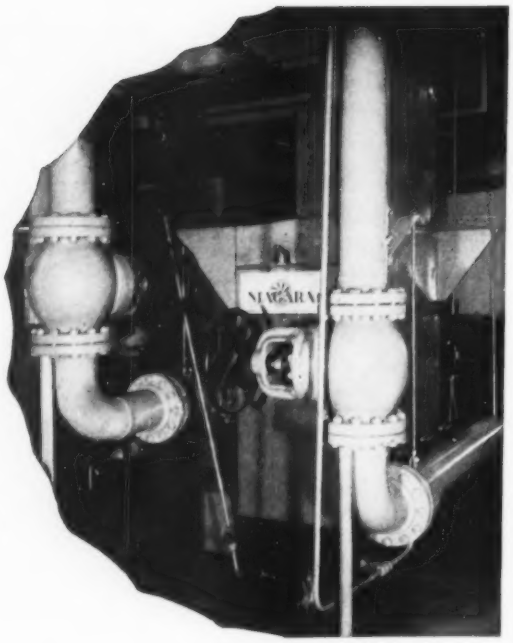

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continued from page 105

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Process Extraction Turbine

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the total work of the entire turbine is:

$6300 \text{ kw} \times 3413 = 21{,}501{,}900 \text{ Btu/hr},$

it follows that the work of the high pressure section is the difference, or:

$$21{,}501{,}900 - 15{,}526{,}000 = 5{,}975{,}900 \text{ Btu/hr.}$$

Therefore, the flow change required to reduce the shaft work of the high pressure section to zero is:

$$\frac{\text{Output}}{\text{Work Increment}} = \frac{5{,}975{,}900}{117.5} = 50{,}800 \text{ lb per hr,}$$

and the flow for zero work in the high pressure section of the turbine is 61,700 − 50,800, or approximately 11,000 lb per hr.

The Willan's line for the high pressure section is now established (Fig. 2). Where the shaft work is zero, the throttle flow is 11,000 lb per hr, and the work at the maximum flow of 184,000 lb per hr is:

$$(184{,}000 - 11{,}000)\ 117.5 = 173{,}000 \times 117.5 = 20{,}327{,}500 \text{ Btu/hr.}$$

This is the maximum capability of the section.

For a throttle flow of 164,000 lb per hr, the total work of the section is:

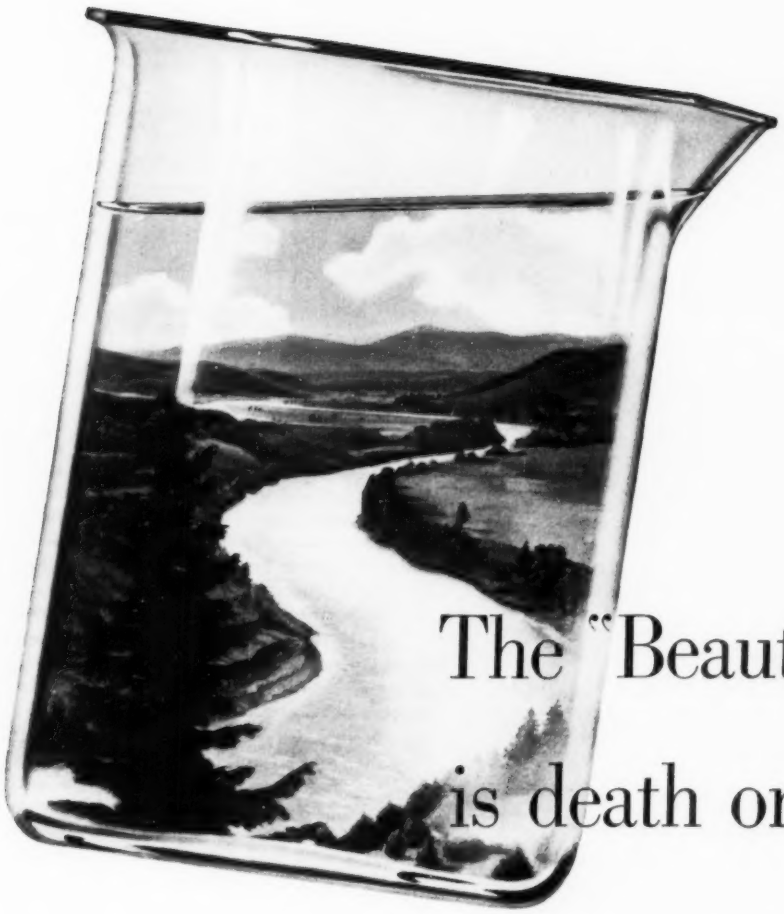
$$(164{,}000 - 11{,}000)\ 117.5 = 153{,}000 \times 117.5 = 17{,}977{,}500 \text{ Btu/hr.}$$

The work per pound of steam is:

$$\frac{\text{Total work}}{\text{Total flow}} = \frac{17{,}977{,}500}{164{,}000} = 109.7 \text{ Btu/lb.}$$

This is the actual energy removed from each pound of steam as work. The enthalpy of the steam at the 150 psia extraction point is simply throttle enthalpy minus work. Then the extraction enthalpy is:

$1379.9 - 109.7 = 1270.2$ Btu per lb.



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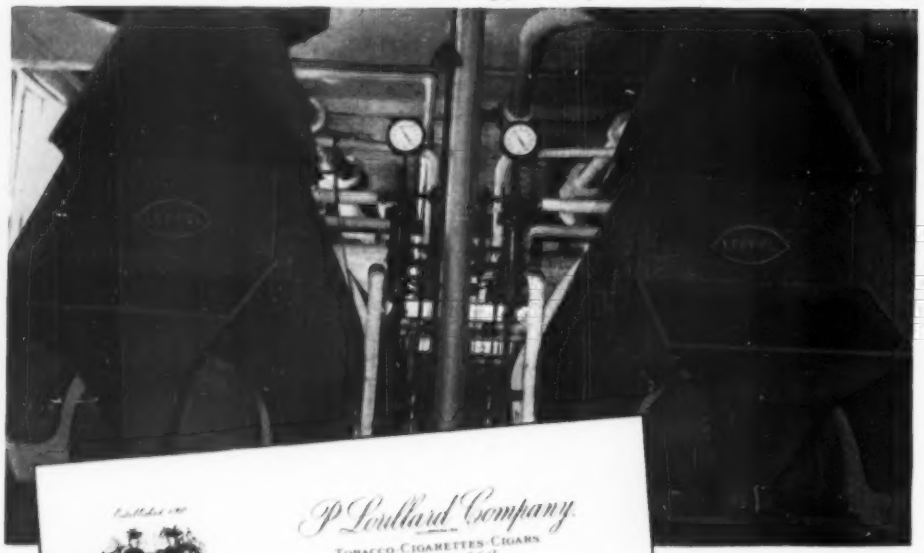

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Steam at 150 psia having an enthalpy of 1270.2 Btu per lb has 135 F superheat.

The heating value of the extraction steam is that which it would give up in condensing to saturated liquid at 150 psia. In this case:

$h - h_f = 1270.2 - 330.5 =$ 939.7 Btu per lb.

Saturated steam at 150 psia, as from a boiler, would give up h_{fg}, or 863.6 Btu per lb. Then, each pound of extracted steam is equal in heating effect to:

$$\frac{939.7}{863.6} = 1.0882 \text{ lb saturated steam.}$$

If the extraction flow at 150 psia is 80,000 lb per hr, the equivalent saturated steam flow is:

$80{,}000 \times 1.0882 = 87{,}056$ lb per hr.

Steam conditions at the 75 psia extraction opening are more difficult to determine, because the intermediate section is operating with variable inlet conditions.

Basically, the efficiency of a turbine depends on relative velocities and blade angles, and the blade angles are fixed when the turbine is built. In constant speed operation, which is usual, only the steam velocity varies with a change in load. The steam velocity is related directly to enthalpy drop. Therefore, the maximum work per pound of steam in a turbine stage is the same, for all practical purposes, regardless of inlet conditions; or, more precisely, the work increment for the stage is constant. That is, the slope of the Willan's line is not changed, but the zero-work steam-flow varies with inlet conditions.

The steam velocity in a blade passage depends entirely on the volume flow, indicating that volume is a proper basis for determining the work per pound of steam. To be precise, it would be necessary to work backwards from the outlet of the intermediate stage of this turbine and calculate various pressure drops, stage by stage, to the inlet. As a good approximation, however, a Willan's line based on inlet volume flow can be used to determine the work per pound of steam.

The Willan's line for the intermediate section, as it would fit the extraction chart, is shown in Fig. 3 together with a curve showing the approximate work per pound of steam versus the volume flow.

It is not necessary to consider the volume of the steam, as such, for the high pressure section of the turbine because the inlet steam conditions do not change.

Following the figures given previously, with a throttle flow of 164,000 lb per hr and extraction 80,000 lb per hr at 150 psia, the steam entering the intermediate section has an enthalpy

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the hourglass shape...

...it may have been fine for Fannie,

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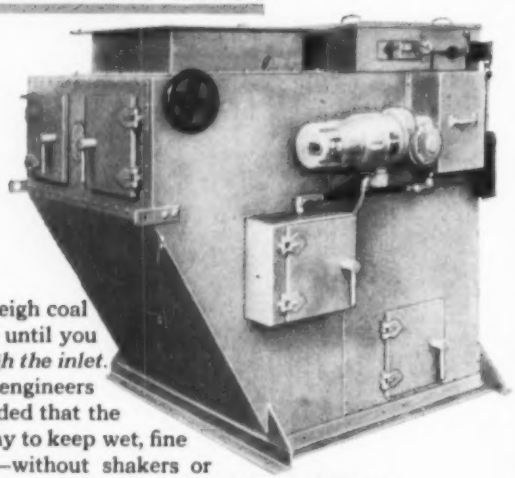

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Process Extraction Turbine

continued from page 109

of 1270.2 Btu per lb, and a volume of 3.65 cu ft per lb. The volume flow is:

$$84{,}000 \text{ lb per hr} \times 3.65 = 306{,}600 \text{ cu ft per hr}$$

From the curve shown for the intermediate section, the work per pound of steam is 41.7 Btu per lb. The steam at the 75 psia extraction point has an enthalpy of: 1270.2 − 41.7 = 1228.5 Btu per lb. The extracted steam at 75 psia therefore has 86 F superheat. Its heating effect is:

$$h - h_f = 1228.5 - 277.4 = 951.1 \text{ Btu per lb,}$$

and the equivalent saturated steam is:

$$\frac{951.1}{904.5} = 1.0515 \text{ lb saturated steam.}$$

If the extraction flow at 75 psia is 80,000 lb per hr, the equivalent saturated steam flow is:

$$80{,}000 \times 1.0515 = 84{,}120 \text{ lb per hr.}$$

Table II gives the results of calculations for a number of load conditions. There is no need to mention any specific trends, except the obvious fact that the extracted steam tends to be highly superheated at low rates of steam flow through the high pressure and intermediate sections of the turbine.

Best Fan Control Method

continued from page 83

slip coupling is roughly 50 per cent efficient, but the fan only takes one-eighth the rated power so ⅛ divided by 50 per cent is one-fourth the full load power.

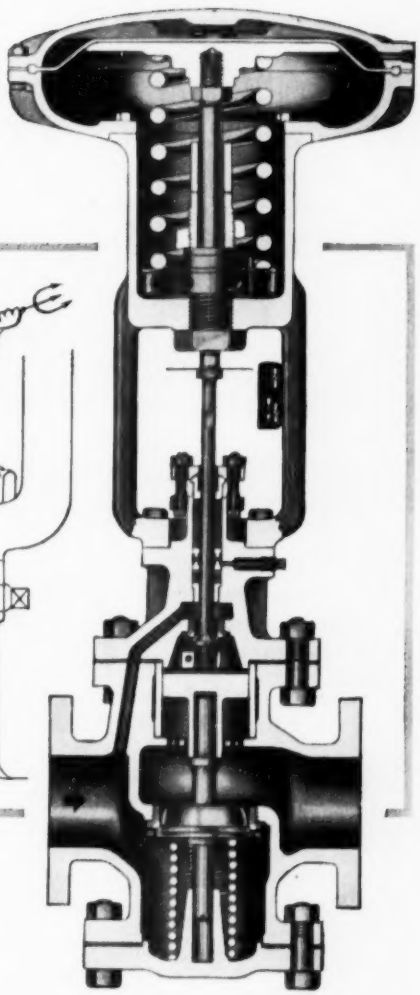
Much has been written about the relative merits of constant speed fan operation with inlet vane control and variable speed operation with fluid drive as far as power saving and investment costs are concerned. Figure 8 compares the power required on the motor output shaft when driving a constant speed fan without inlet boxes, but with inlet vane control, with the motor power input to a fluid drive operating the same type and capacity fan at variable speed. From 100 per cent down to 75 per cent capacity, inlet vanes are the most efficient, but below this point the superiority of the fluid drive is very marked.

In order to stay in the efficient operating range, vane control fans are often selected with less reserve capacity than might be desirable if variable speed fluid drive were used. This of course limits the short time peak load of the steam boiler under adverse conditions. In the power generation field this reserve fan capability is often priceless. The term "base load" refers to the generator

continued on page 116

PACKING PROBLEMS?

The new Leslie Lubrisoft® Packing now standard in all Leslie Diaphragm Control Valves is recommended for valve body temperatures up to 500° F. *without external lubrication*. When used with the Leslie thermo-isolating bonnet, it may be used for valve body temperatures up to 1050° F., eliminating need for external lubricators and isolating valves in most applications.



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1. **Internal pressure, temperature and fluid**
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3. **Corrosion**
4. **Electrolytic Action**
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7. **Abrasion**
8. **Friction**

Overall result is a standard, economical packing, with superior stem sealing properties and long service life. Precision fabricated to conform exactly to the deep stuffing box dimensions, the positive, split ring design makes fast replacement possible, without disturbing body or stem adjustment.

Plan to reduce control valve maintenance costs by sending for Bulletin 5304 Diaphragm Control Valves.

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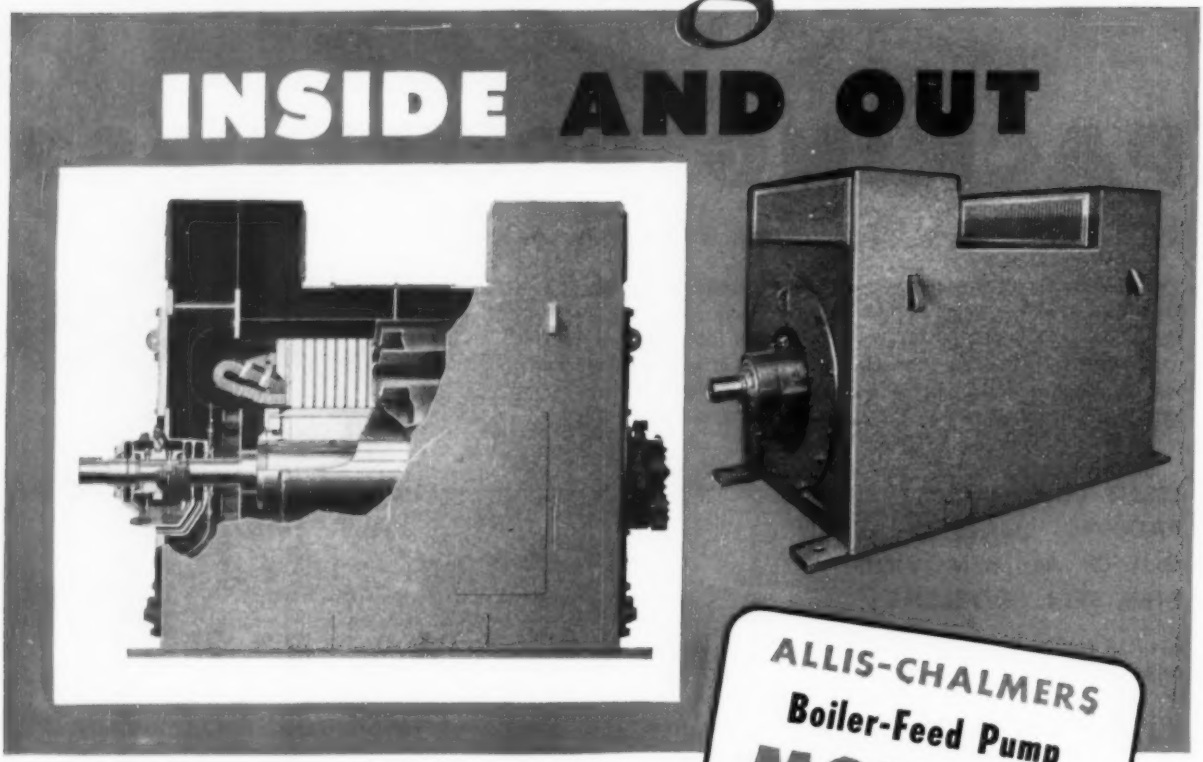

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New features improve 2-pole motors long known for reliability and low maintenance.

New ventilating arrangement features top air intake and discharge *plus* spiral stator core ventilation. Top intakes (available with filters) keep motor clean and make motor room cleaning easy; top discharge adds to personnel comfort. Spiral ventilation — used in turbine generators — assures even internal cooling . . . combines with centrifugal fans and baffled air passages to reduce noise.

Improved bearing design simplifies maintenance, prevents oil leakage. Capsule-type housings — proved in use on other designs — permit inspection of windings without exposing bearings. Oil leakage is prevented by a combination of features, including orifice-metered oil flow, weirs to maintain correct oil level, labyrinth seals, breathers, and annular pressure chambers with atmospheric relief.

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Features that helped build the Allis-Chalmers 2-pole motor reputation for reliability are retained in the new design. These include proven stator coil design, ample stator coil end bracing, thermally and mechanically stable cage assembly, separate balancing rings, and oxygen-free dew-drop cage bars.

This design available in ratings 900 hp and larger. Ask your A-C representative for Bulletin 05R8123. Allis-Chalmers, Milwaukee 1, Wisconsin.

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A-C ALLIS-CHALMERS

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INSTRUMENTS AND CONTROLS

201 Instruments for Steam Generation — Bulletin 9050, 32 pp, is a handy reference for all manufacturer's products applicable to steam generation, including electric, pneumatic, electronic and mechanical types of instruments and controls. Power engineers will find it useful in selecting instrumentation for modernization of package boilers. Minneapolis-Honeywell Regulator Co.

202 Instruments, Controls — Condensed Catalog 1537 offers brief application information on manufacturer's line of instruments. Fully illustrated, covers draft and pressure instruments, flow meters, liquid levels and pressure gages, CO_2 meters, pneumatic transmitters, positioning operators, temperature instruments, boiler feedwater controls, others. Includes references to detailed literature on each type of equipment. Republic Flow Meters Co.

203 Metering and Control Equipment — Sixteen-pp Bulletin 18 is a comprehensive catalog offering information on company's meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate equipment. Bailey Meter Co.

204 Controls for Liquids, Gases — Bulletin 004, 36 pp, is a revised edition of company's general catalog on measuring and control equipment. This practical book contains information on many types of controllers, gages, manometers, recorders, meters, valves, Venturi tubes etc., applicable for water and sewage works, power and processing industries. Simplex Valve & Meter Co.

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205 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

206 Steam, Liquid Control Equipment — Catalog 54, a 56-pp edition commemorating this company's 40th anniversary, is arranged for easy reference. Covers pressure regulators, temperature regulators, combination regulators, float valves, strainers, pop safety valves, relief valves, diaphragm valves, motor-operated

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and solenoid valves. In this book, tabular matter is simplified for quicker reading of specifications. Included are quick reference tables on pressures and temperatures, and flange data. O. C. Keckley Co.

207 Electronic Feedwater Control — Three systems for the electronic regulation of boiler feedwater are explained briefly and diagrammed in Bulletin 52-1073-221. They include a single-element, two-element, and three-element system. Applications for each type are given, and descriptions of the flow measuring, receiving, level measuring elements, power unit and valve are included. The Hays Corp.

208 For Feedwater Analysis — Bulletin 148 BP contains a technical discussion of manufacturer's analyzers for determination of dissolved oxygen and hydrogen in feedwater. Discusses both O_2 and H units as to function, ranges, accuracy. Cambridge Instrument Co., Inc.

ELECTRICAL EQUIPMENT

209 Motor-Generator Reference Book — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither text book nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, information on methods of speed control. Allis-Chalmers Mfg. Co.

210 The Answers on Wiring — "20 Questions and 20 Answers on Safety m.i. Wiring" describes and illustrates characteristics and advantages of this new wiring system. A complete table of types, sizes, weights and lengths, as well as a partial list of users included. General Cable Corp.

211 Wire, Cable Ordering Guide — Newly-released General Catalog W-52-3, 186 pp, presents more than 500 different types of wires and cables. Contains comprehensive data on construction and operating characteristics for control and signal cables, cables for construction work, telephone wire and cables, and portable cords. A technical engineering data section is included. Available to qualified power engineers. United States Rubber Co.

212 Power Distribution Practices — The 28-pp "Industrial Power Distribution Idea Book" (Bulletin GEA 5900) is a guide on electric power distribution practices in large and small plants. Covers utility distribution practices; methods of buying electric power; what to do when a choice of primary voltages is available; application of primary switches and circuit breakers; types and arrangements of primary cables; and types of load-center distribution systems. General Electric Co.

213 Insulation Temperature-Resistance — Technical Publication 21T4, 16 pp, is an article on temperature-resistance characteristics of electrical insulation. Complete with tables and graphs, gives general information on variations in temperature characteristics, composite nature of electrical insulation, and practicability of temperature compensation. Other chapters deal with determining insulation constants for temperature correction factors, dielectric absorption characteristics, and a practical method of obtaining insulation temperature. James G. Biddle Co.

continued on page 120

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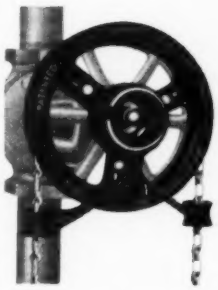

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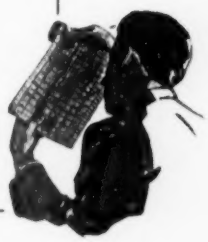

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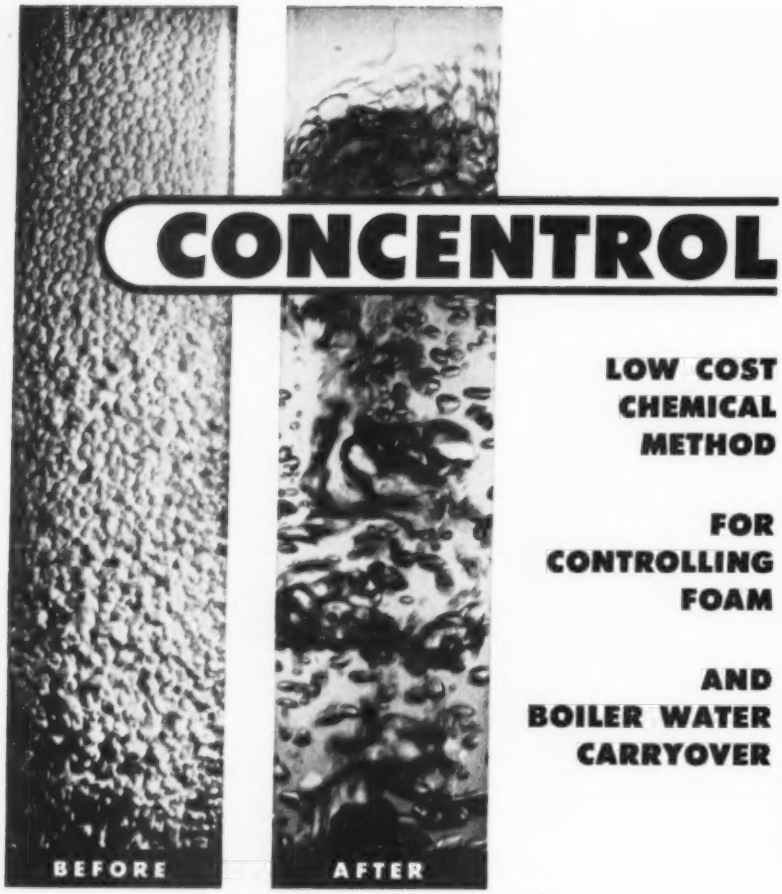

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Best Fan Control Method

continued from page 110

output and has little meaning with respect to the fan requirements which vary with changes in the boiler, superheater, air heater and dust collector tightness and cleanliness, the ambient temperature and humidity as it affects the condenser vacuum, the weight of air entering the forced draft fan, the stack draft, and changes in fuel quality and moisture content. Further, the base load generator of today is likely to be replaced by larger and more efficient units before a large portion of its useful life is gone.

Operators of power plants with variable speed forced and induced draft fans are happiest with their fan selections when they can get maximum safe continuous generator output, with the boiler and auxiliaries in good, average, clean condition, with the proper fuel and at the ambient temperature corresponding to their season peak load, and with the forced and induced draft fans operating at 65 to 70 per cent of maximum capacity and speed. This provides the 50 per cent margin of capacity for operational hazards, and safety factors for designer and manufacturers, which will protect the capital investment in the entire unit in its ability to deliver its rated kilowatts at all times even under adverse operating conditions.

Therefore, the range of power comparison that has importance in Fig. 8 is from 70 per cent down to 35 per cent capacity corresponding to full load and half load generator output under good normal conditions. In this range the power saving with variable speed drives is very substantial. In the upper capacity range where vane control is most efficient there is actually very little normal operation.

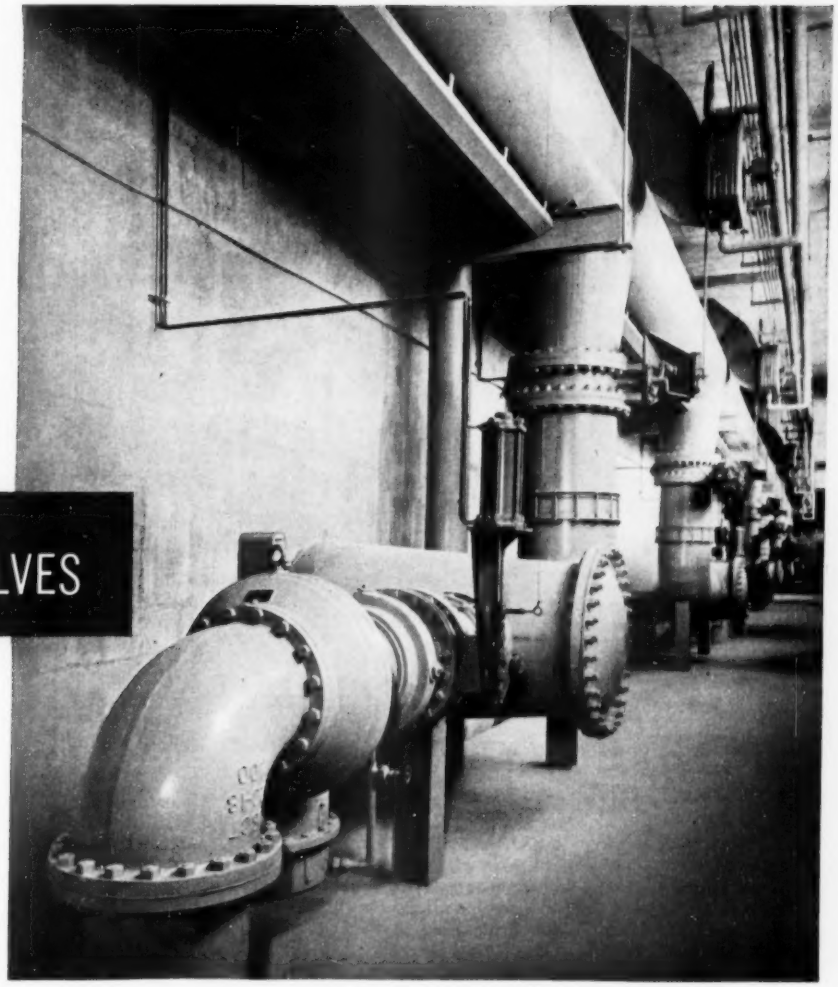
NEW ENGINEERING BOOKS

Technical Illustration, by various authors; 62 pages plus 22 plates; illustrated; size 8½ by 11 in.; heavy paper cover. Published by Higgins Ink Co. Inc., 271 — 9th St., Brooklyn 15, N. Y. Price $2.50.

Here is one of the most practical and attractive books on technical illustration we have yet seen. It has been under preparation for some years under supervision of Bertram Cholet. It is planned to fill a wide-spread need for material on three dimensional drawing, an art which is all but ignored in the field of engineering education, according to Mr. Cholet.

The book's major chapters have been assembled by Anthony D. Pyeatt and cover axonometric and perspective drawing for

R-S
BUTTERFLY VALVES



San Jacinto Project uses 65 large R-S Butterfly valves

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Choosing R-S Rubber-Seated Butterfly Valves* enabled Freese, Nichols & Turner, Consultants on the San Jacinto River project, to save $124,000 for the City of Houston. Use of 65 of these valves for all low-pressure service gave a substantial space reduction and the direct, in-place cash savings over gate valves. SMS cone check valves were also chosen for pump discharge service.

Positive closure in R-S Rubber-Seated Valves is obtained by wedge-type closure of the disk within a one-piece rubber seat. Tough, flexible rubber seals the entire disk seat – including the area around the shaft bosses. Supervised testing of a six inch R-S Rubber-Seated Valve proved that after 6,000 closings the valve was still giving positive shutoff at 100 psig water.

These valves are the product of over 75 years of design and engineering experience in the hydraulics field. To find out more about our complete line–R-S Butterfly, Rotovalves and Ball Valves – write to S. Morgan Smith Company, York, Pennsylvania.

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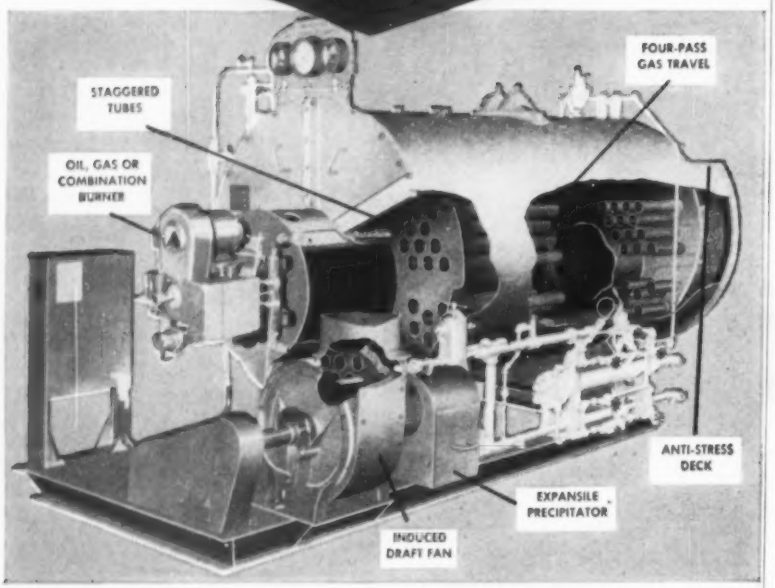

Look into this self-contained, perfectly coordinated, compact, "packaged" boiler plant and you'll readily see why the Preferred Unit Steam Generator offers you the utmost in smooth-functioning heating efficiency. Truly a boiler built beyond the codes for installation and fully automatic operation at lowest cost! It's a 25-year investment in dependable, economical operation that pays for itself in less than 5 years.

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All Preferred Unit Steam Generators are factory fire-tested before shipment. Made in sizes from 20 to 600 B.H.P. and pressures from 15 to 250 p.s.i. to burn oil, gas or in combination.

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modern industrial illustrations. The book includes 22 plates of illustrations by Bryan G. Smith. Both Messrs. Pyeatt and Smith are connected with the Douglass Air Craft.

The book first takes up the uses of industrial aids, then covers three-dimensional drawing in detail, with many illustrations, then axonometric drawings including isometric projection, dimetric projection and trimetric projection.

Mechanical aids to three dimensional drawings are given, correct use of drawing ink is discussed together with the pens and techniques required, and the book concludes with 22 plates showing rendering techniques such as ink outline, pen rendering, stipple shading, scratch board, air-brush work, cut-away views, overlays, and others.

This book, it seems to us, presents data on the technical illustration methods actually in use today by industry.

OBITUARIES

Walter J Welch

WALTER J WELCH, 77, died July 13 at El Cajon, Calif. Mr. Welch went to Chicago from Fort Wayne, Ind. in 1910. For 37 years he was associated with Pioneer Service & Engineering Co. and its predecessor organizations, serving for the greater part of that period as chief design engineer.

He retired in 1947, and moved with his family to El Cajon. He is survived by his widow, Jean, and a son, Walter Roll Welch of Park Ridge, Ill.

C. Dudley Armstrong

C. DUDLEY ARMSTRONG, a director and former vice-president and secretary of the Armstrong Cork Company, Lancaster, Pa., died June 8 at the home of his son-in-law, Dr. J. J. Kohlhas, in Haverford, Pa. Mr. Armstrong had been ill for some months. He was 65.

C. Dudley Armstrong retired as secretary and vice-president in charge of Foreign Operations of the company last September, but remained on the board of directors, of which he had been a member since 1917.

He entered the employ of the Armstrong Cork Company in 1910 following his graduation at Yale University where he was second in his class.

One of his first assignments in the company was a tour of duty with the Spanish subsidiary where he learned the fundamentals of the cork business.

After his discharge from the service, Mr. Armstrong returned to the company's headquarters in Pittsburgh where he engaged in the general ad-

ministration of the business, including sales statistics and the organization of the British subsidiary, Armstrong Cork Company Limited. He was elected first vice-president of the company in 1920.

In 1927, he was made general manager of the subsidiary, Armstrong Cork and Insulation Company, and two years later he was appointed general manager of the Cork Department. Early in the 1930's, he was placed in charge of Foreign Operations in which capacity he brought about many important changes and revitalized the entire activity. In 1937, his responsibilities were further increased when he was elected secretary of the company.

William Sesher

WILLIAM A. SESHER, president and founder of the Synco Corp., Emmaus, Pa. near Allentown, died in Amuay, Venezuela, while on a business trip. He was 51.

Mr. Sesher, who lived at Lanark, founded the Synco Corp. in 1940 in Clifton Heights, and moved the firm to Emmaus four years ago. He developed a process for coating metal surfaces with synthetic rubber to prevent corrosion.

He formerly was an engineer with the U. S. Rubber Co. and the Electro-Chemical Engineering and Manufacturing Co. of Emmaus.

He was a member of the Engineers Club of Philadelphia; and the National Association of Corrosion Engineers.

Rawson Vaile

RAWSON VAILE, 67, prominent Detroit industrialist of Birmingham, Mich. died June 19, in the Harper Hospital at Detroit, after a prolonged illness. He was executive vice president and director of the American Blower Corporation, Dearborn, Mich. and a director of the Canadian Sirocco Company, Limited of Windsor, Ontario.

Mr. Vaile was graduated from Purdue University in 1909 with a B.S.M.E. degree. He took post graduate work at Columbia University and went to American Blower in 1912 as a sales engineer. He was soon assigned to the Pittsburgh office and was transferred to the Rochester office in 1913. In 1914 he was made manager of the corporation's Export Department with offices in New York. He was made general sales manager in 1916 and remained in that capacity until 1917, when he joined the United States Army as a 1st Lieutenant. Following his discharge from the Army in 1919, Mr. Vaile resumed his duties as sales manager until 1922, at which time he was made assistant secretary. During the next few years he was successively appointed secretary, secretary and treasurer, and in 1933 was appointed executive vice president.

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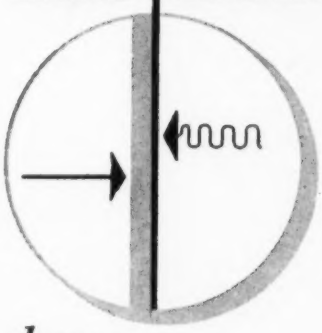

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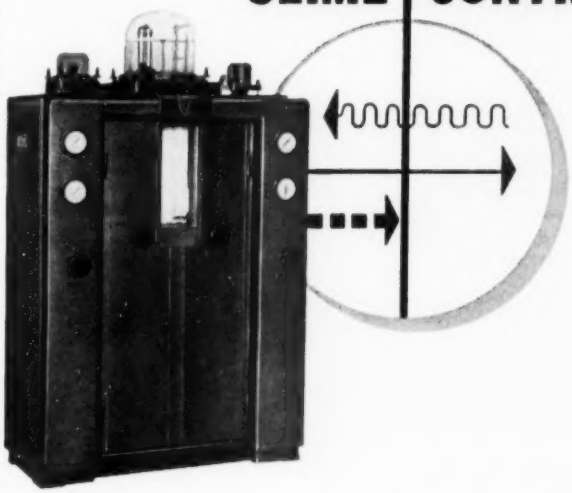

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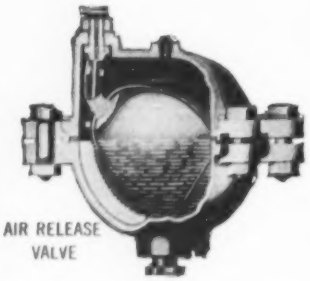

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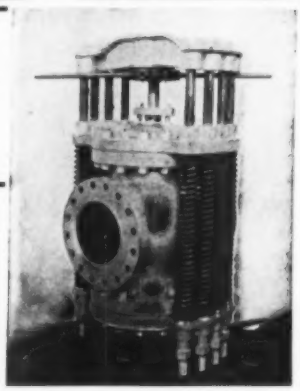

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continued from page 114

214 Electrical Maintenance Tips — Booklet B-5477, 28 pp, gives a complete outline of preventive electrical maintenance. Discusses general maintenance programs designed to reduce shutdown time and treats in detail the maintenance of power equipment. A suggested schedule of work and cleaning on power equipment is presented in chart form. Essential information on preventive maintenance for turbines, generators, switchboards, motors is given. Westinghouse Electric Corp.

WATER CONDITIONING

215 Handbook on Demineralizing — Bulletin 5800, 39 pp, on treating water by demineralizing, explains principle of ion exchange. Discusses applications of many anion and cation exchange materials; series of curves help estimate cost of operation. Describes design and operation of demineralizer systems, multi-stage systems and mixed bed units. Cochrane Corp.

216 Modern pH and Chlorine Control — This 100-pp booklet gives details in color comparators and equipment in water testing and control of boiler and industrial process water, also technical information on meaning of pH control, electrometric and colorimetric methods of determining pH and impurities in water; applications of water control in air conditioning; feedwater. W. A. Taylor & Co.

217 What's What on Ion Exchangers — Here are three booklets on ion exchangers: Nalcite HCR, a styrene type cation exchanger; Nalcite SAR, a strongly basic anion exchanger; and Super Nalcolite, a synthetic gel type zeolite for cation exchange. Tables and graphs explain performance of these water treating resins under various operating conditions. Physical characteristics, exchange capacities, regeneration techniques are discussed. National Aluminate Corp.

218 Demineralizers — Valuable information on demineralization is offered power engineers in comprehensive 24-pp Bulletin WC-111. Discusses demineralization in general and its advantages and applications. Basic types of demineralizers and their special users are charted. Resins, piping, valves and accessory equipment are treated in detail. Book also provides flow charts showing demineralization systems. Graver Water Conditioning Co.

219 Water Conditioning Data Book — A recently revised reference volume, Data Book 2478A contains 108 pp and presents a compilation of 78 chapters and tables. Subjects covered include hydraulics; impurities in water; chemical conversions; coagulant, acid and alkali dosages; chemicals used in water treatment; water treatment processes; boiler feed make-up requirements; alkalinity relationships; specific gravities; chemical reactions. Available to qualified power engineers, please state your job title when requesting this. The Permutit Co.

220 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

221 Microbiological Control — Technical Article 3C, 12 pp, is an illustrated discussion of microbiological control of and through industrial waters. A section on industrial water chlorination covers cooling waters and process waters. Other sections deal with chlorine metering in chemical processes, and the sanitary aspects of industrial water treatment. Wallace & Tiernan Co., Inc.

FUEL OILS, LUBRICANTS

222 Diesels, Their Fuels and Lubricants — This 46-pp book gives practical information on diesel engines, covering their history and economics as well as design characteristics and operating principles. Classification of diesels according to speed is covered. A chart shows relation of engine performance to fuel properties. Sinclair Refining Co.

223 Versatile Industrial Oil — Described in 20-pp Form AD 4078 is an all-purpose oil offering protection for a wide range of industrial equipment, and available in 15 viscosity grades. Discusses six major characteristics of the oil; explains and pictures its use in hydraulic systems, speed reducers, air compressors, electric motors, hydraulic turbines, bearing systems, etc. A chart shows grades available, their uses and physical properties. Standard Oil Co. (Ind.)

224 Turbine Lubrication — The special problems of turbine lubrication are discussed in 8-pp Bulletin TU-1. Tells how purifiers keep power units in service; discusses inhibited and uninhibited oils, company's process for reducing sludge formation within lubrication system. Illustrated with diagrams of typical installations. DeLaval Separator Co.

225 Compressor Lubrication Problems — Vol. 40, No. 1 of Lubrication provides a 14-pp article on problems associated with compressor lubrication. Reviews compressor types, function of the lubricant and importance of adequate installation. Air compressor explosions and receiver fires are discussed, as are condensation and compressor cooling, bearing lubrication, selection of lubrications. Special problems of air, gas, refrigerator, and other compressors are treated. Includes lists of factors which control dependable compressor operation. The Texas Co.

226 Air Compressor Lubrication Manual — Valuable information on air compressor maintenance is contained in this 40-pp book. Subjects treated include compressed air, compressors and related equipment, lubricating systems, compressor oils and applications, lubrication requirements, operating hints, oil requirements, storage and care of compressor oils. Cities Service Petroleum, Inc.

227 Cooperative Technical Consultation Service — This informative 24-pp booklet presents company's periodic consultation service aimed at the most efficient use of petroleum products. Covers services available in the solution of lubrication problems, metalworking operations, processing, fuel oils, dust control. Gulf Oil Corp., Gulf Refining Co.

BOILERS, GENERATORS

228 Shop Assembled Boiler — Sixteen-pp Bulletin G-76 completely describes and illustrates company's Type FM water-tube integral-furnace boiler, made in standard sizes from 2900 to 28,000

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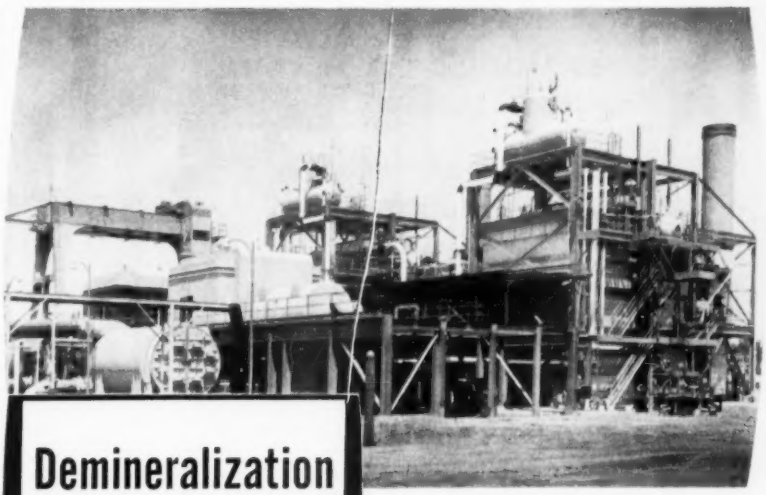

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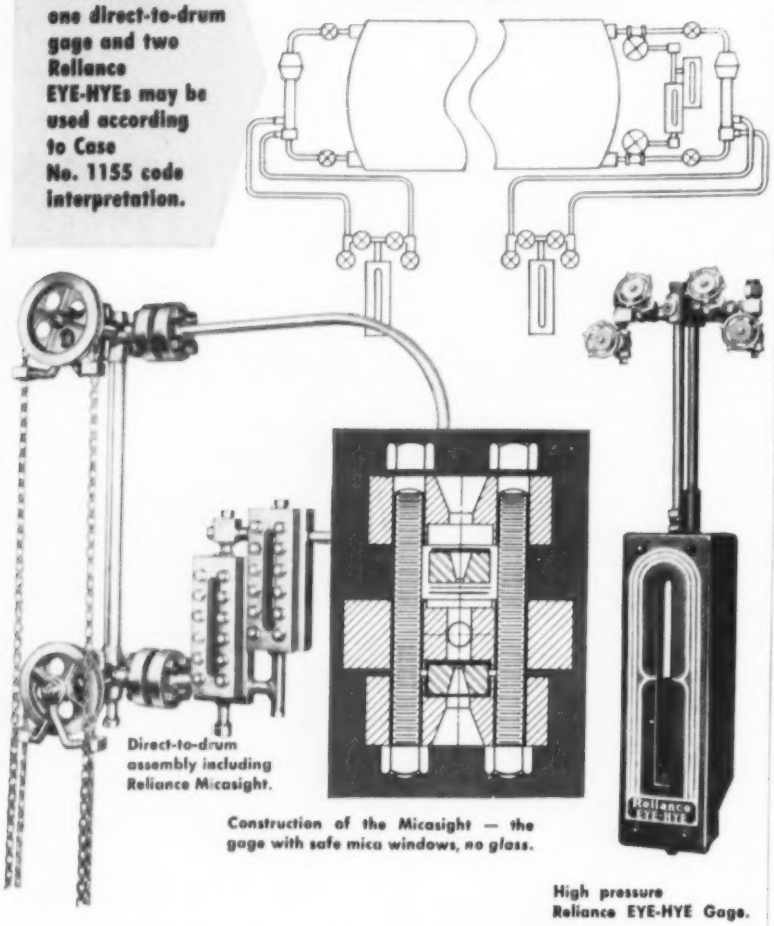

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lb of steam per hr, pressure to 250 psi. Savings in erection, installation and moving costs are stressed. Capacities, dimensions of the boilers are given. The Babcock & Wilcox Co.

229 Packaged Boilers — This 16-pp illustrated catalog describes manufacturer's new Type VP package boiler. Following a section of background information is an outline of the principal design features of these boilers, which are shop assembled and provide steam capacities from 4000 to 30,000 lb per hour. Space requirements are shown in a table along with typical specifications. Also described is control system. Combustion Engineering, Inc.

230 Scotch Marine Boilers — Bulletin 236 illustrates and describes a Scotch type of boiler on skids suggested for a wide range of applications. This boiler can be hand- or stoker-fired with coal or can use oil, gas or wood as fuel. Gives construction details, stresses versatility, other advantages. Includes test data and specifications. The James Leffel & Co.

COAL, ASH HANDLING

231 Economic Coal Storage — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; pictures several models. Tractor Div., Allis-Chalmers Mfg. Co.

232 Spreader Stoker — Sixteen-pp Bulletin 800 describes manufacturer's Type C-C RotoStoker, a relatively small spreader stoker offering continuous cleaning and ash discharge advantages of larger units, without need of a basement for ash removal. Explains this and other operational advantages of the stoker, which is adapted to modern steam boilers with output capacities of about 5000 to 75,000 lb of steam per hour. Detroit Stoker Co.

233 Shredder Ring Crusher — A crusher for coal and similar materials which features rolling shredder rings is described in this 8-pp bulletin. Gives details on a survey of 29 mines and power plants in which this type crusher is installed. Informative tables giving speed, capacity, horsepower, weight and dimensions of crushers, as well as cost data are included. American Pulverizer Co.

234 Spreader Stoker Selection — Fourteen-pp Form F-520-A10M is intended to help those choosing a spreader stoker to get the most for their investment, and it points out many factors to be considered. American Engineering Co.

235 Spreader Stoker Data — This is a file of three illustrated bulletins on spreader stokers. The first discusses seven reasons for selecting these stokers and describes their design, construction and operation; the second, dumping grates, the third, installations. Riley Stoker Corp.

236 Why Liquid Diffusion — What liquid diffusion can do for power plants is explained in Form B, which tells how liquid diffusion compounds work and gives four practical applications. These include dust control in coal handling, fly-ash control, coal storage pile treatment and boiler cleaning. Johnson-March Corp.

237 Automatic Coal Scale — Sixteen-pp Bulletin 0352 describes an automatic coal scale for weighing coal as it is

fed to boilers, enabling a power engineer to maintain a constant check on boiler efficiency. Book gives construction and operating details on the belt feeder, weigh hopper, scale housing, operating levers and accessories. Photos and line drawings show scale features. Richardson Scale Co.

TUBING AND ACCESSORIES

238 Condenser Tubes — Excellent information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Gives details on proper installation. Scovill Mfg. Co.

239 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads. Roto Div., Elliott Co.

VALVES, TRAPS, PIPING AND ACCESSORIES

240 Safety Valve Engineering Data — How company's safety valve works and its operating advantages are explained in Bulletin 707. Includes dimensions on valve types, also provides tables on superheat correction factor. Manning, Maxwell & Moore, Inc.

241 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principle of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

242 Steam Valve Calculator — A slide-chart calculator that quickly estimates pressure drop and indicates proper size steam valve needed for any pressures up to 1500 psi is now available. Printed on calculator are operating instructions. Golden-Anderson Valve Specialty Co.

243 General Service Valves — Bulletin E-160, 16 pp, describes and illustrates design and construction of company's quick-operating valves, explaining their application to blow-off service and on chemical process, soot blowers, water column blow-down, and other types of pipe line. Everlasting Valve Co.

244 Valve Chart — Form 194, 24-pp, is a valve comparison chart, listing valve

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figure numbers of 15 major manufacturers and the OIC equivalent valve figure numbers. Compares variety of valves in ferrous and non-ferrous materials, describes different valve lines. The Ohio Injector Co.

245 Pump Valves — Sixteen-pp Catalog SC-510, now available to power engineers, describes and illustrates valves made to fit practically all makes of reciprocating pumps. Key features of the valves are discussed, and standard, lock-in and deck types are covered in detail. Sims Pump Valve Co., Inc.

246 Valve Specialties — Included in 90-pp Catalog A-50 is ordering and engineering information on automatic pressure flow and liquid level controls for steam, air, gas, water, oil, other fluids. Sections are devoted to pressure regulators, Altitude valve, pump governors and strainers; lever, float and motor operated valves; pilot valves; back pressure, relief and non-return valves, steam trap and air vent; liquid level controllers; solenoid valves. Davis Regulator Co.

247 Butterfly Valves — Construction details, engineering and application data on butterfly valves are provided in three illustrated bulletins. Eight-pp Bulletin 557 covers those of standard heavy-duty construction; Bulletin 558, 8 pp, those of standard medium-duty construction; and Bulletin 559, rubber-lined butterfly valves. W. S. Rockwell Co.

248 Blow-Off Valves — Bulletin B-426, 20 pp, on blow-off valves for boiler pressures up to 400 lb wsp, contains installation recommendations, construction information on Yarway seatless and double-tightening blow-off valves. Gives full ordering data. Yarnall-Waring Co.

249 Lubricated Plug Valves — Revised Catalog PV-2, 12 pp, presents steel and semi-steel valves designed to offer quick shut-off of erosive or corrosive fluids. Explains advantages of the lubricated tapered plug design of these valves and pictures single gland, screwed gland, and bolted gland types. Also shows accessories. The William Powell Co.

250 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

251 Regulating Valves — Bulletin 5305 describes double seated diaphragm regulating valves for use with control instruments, outlining special features of the valves, particularly the "flow line" contoured body engineered for high capacity at low pressure drop. Leslie Co.

252 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

253 Steam Trap Solutions — Bulletin F.151, 36 pp, is a newly revised edition of this company's well known booklet, "Solving Steam Trap Problems." Organized for easy reference, this illustrated booklet provides specifications and capacities of steam and float traps, air release valves, pipe line strainers. Tells how to calculate condensation loads and select traps for unit heaters, jacketed kettles, submerged surfaces. Gives pointers on installing and servicing traps. The V. D. Anderson Co.

254 Piping Pointers — This is company's highly popular 36-pp manual covering fundamentals of sound piping practices. Discusses various types of valve designs and how each should be used. Pictures and names more than 80 fittings and contains illustrated how-to-do-it features. Includes selection guide. Crane Co.

255 Improved Pipe Hanger — Twelve-pp Bulletin 153 describes company's Counterpoise pipe hanger for high temperature piping systems in steam generating stations, refineries and chemical plants. Tells how it offers efficient load supporting effort of constant value throughout entire range of travel as pipe expands or contracts because of temperature changes. Graphs for selecting proper hangers, tables of dimensions, plus erection are given. National Valve & Mfg. Co.

PACKINGS, GASKETS, SEALS

256 Seals for Bearings — Complete information on manufacturer's Klozure oil and grease seals for bearings is available in 100-pp Catalog 10. Fully illustrated in color, pictures all types of these seals, typical applications and lists sizes and part numbers. Also describes mechanical pressure seals for rotary shafts. The Garlock Packing Co.

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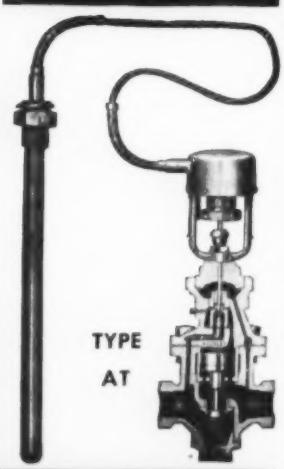

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257 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for many applications. Packing Div., Raybestos-Manhattan, Inc.

OTHER EQUIPMENT

258 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers and other furnaces, where steam or compressed air is available for atomizing the oil. Includes information on furnace design and construction. National Airoil Burner Co., Inc.

259 Refrigerator Condensers — Bulletin RC-2, 38 pp, utilizes drawings, tables and engineering data to show how to select proper type from company's line of ammonia and Freon condensers for refrigeration services. Illustrates horizontal multipass shell and tube types; vertical singlepass shell and tube types. Gives pipe sizes for ammonia and Freon lines; stands for large and small condensers. Henry Vogt Machine Co.

260 Turbine Speed Control — Thirty-pp wire-bound Bulletin H-21 is titled, "Fundamentals of Turbine Speed Control." It is an elaborately illustrated, educational booklet intended to clarify the operation of common types of automatic speed control for steam turbines. An introductory section covers general fundamentals of automatic control systems, and also includes a key to control terminology. Elliott Co.

261 Power Plant Equipment — This comprehensive folder illustrates some of the equipment and services provided by this company. Shows heat exchangers, filters, condensers; also such services as re-tubing and metal spraying. Condenser Service & Engineering Co., Inc.

262 Sheet and Plate Fabrication — Illustrated in 40-pp Bulletin F-3 are products of this manufacturer, and equipment used to produce special sheet steel and alloy parts. Shows control panels, switch gear housings, cubicles and other electrical enclosures, boiler air ducts, smoke breechings, tanks. The Kirk & Blum Mfg. Co.

263 Automatic Soot Blowing — Bulletin 483 provides 16 pp of basic information about Vulcan automatic and automatic-sequential soot blowing. Includes a wide variety of typical installation drawings to show complete cleaning systems. Copes-Vulcan Div., Continental Foundry & Machine Co.

264 Burning Bituminous Coal — This 24-pp illustrated booklet is a compilation of numerous actual case histories of industrial plants and institutions which burn bituminous coal "the modern way." Stressing operating economy achieved, these case histories show problems overcome, equipment used, and savings realized. Bituminous Coal Institute.

265 Fluid Drive — Of value to power engineers interested in obtaining adjustable speed operation in a range from 100 to 2500 hp is 24-pp Bulletin 9319, illustrated in color. Covers company's Type VS, Class 4 Gyrol fluid drive, explaining its principle of operation and illustrating its use. American Blower Corp.

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266 **Refractories for Heat, Power** — Compiled to help power engineers solve refractory problems and get greater operating efficiency from their boilers, this booklet provides 32 pp of practical information on company's Crystolon refractories. Properties and characteristics of these silicon carbide products are given and separate chapters cover those for air-cooled, solid wall and water tube protection, and for repairs. Norton Co.

267 **Preheating Combustion Air** — This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels, other advantages afforded. Booklet contrasts regenerative with recuperative preheaters; explains operating principle and structural details of the Ljungstrom air preheater. Industrial applications for other than power boilers are also covered. Air Preheater Corp.

268 **Refractory Concrete** — This 28-pp booklet describes company's Lumnite, a calcium aluminate cement for refractory concrete. Discusses characteristics of Lumnite, methods of making refractory concrete. Chapters are devoted to summary of aggregates and proportions; heat-resistant concrete; refractory insulating concrete; insulating over-coats for industrial furnaces; castable refractories. Universal Atlas Cement Co.

269 **Dry Ice Converters** — This illustrated bulletin describes pressure vessels with removable closures into which dry ice is charged and in which the resulting carbon dioxide is stored indefinitely under pressure. Gives advantages of CO_2 for purging or use as an inert gas, and advantages of the dry ice converters as a source of CO_2. Dry Ice Converter Co.

270 **Industrial Equipment** — Bulletin WP-1009-B61, 16 pp, describes manufacturer's industrial equipment including centrifugal refrigeration, condensers and coolers, steam power plant equipment, water conditioning deaerators and rotary pumps. Worthington Corp.

271 **Communication Systems** — Sixteen-pp Form P831 presents communication systems engineered for power plants. Advantages of such a system are given and photos show it in use in turbine rooms, boiler rooms, control rooms, laboratories and outdoors. RCA Victor Div., Radio Corp. of America.

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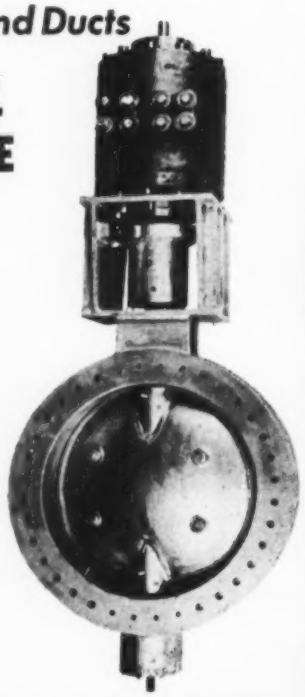

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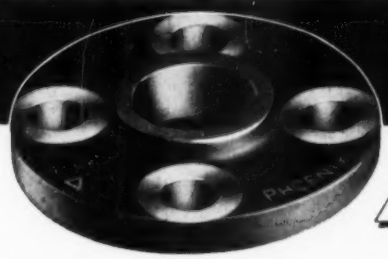

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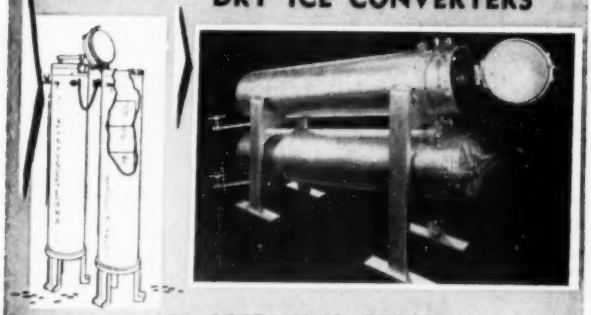

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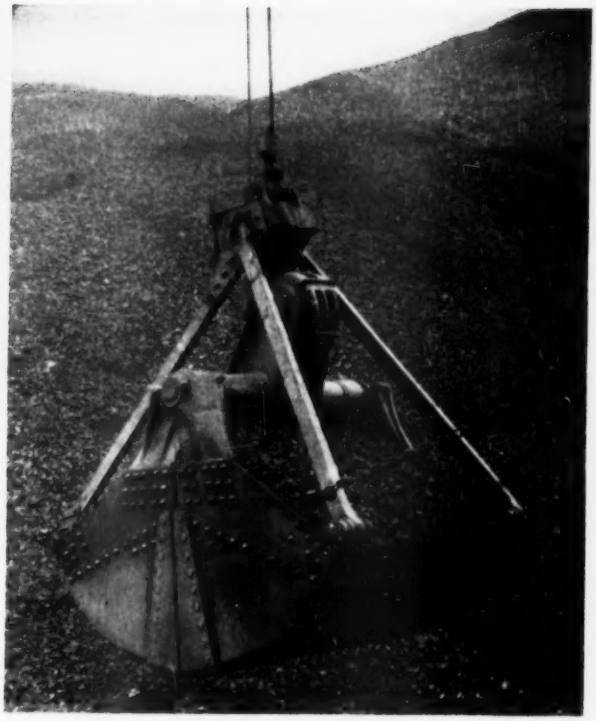

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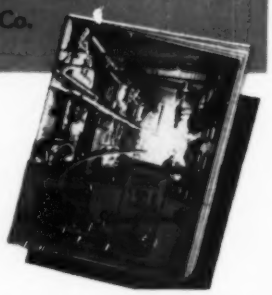

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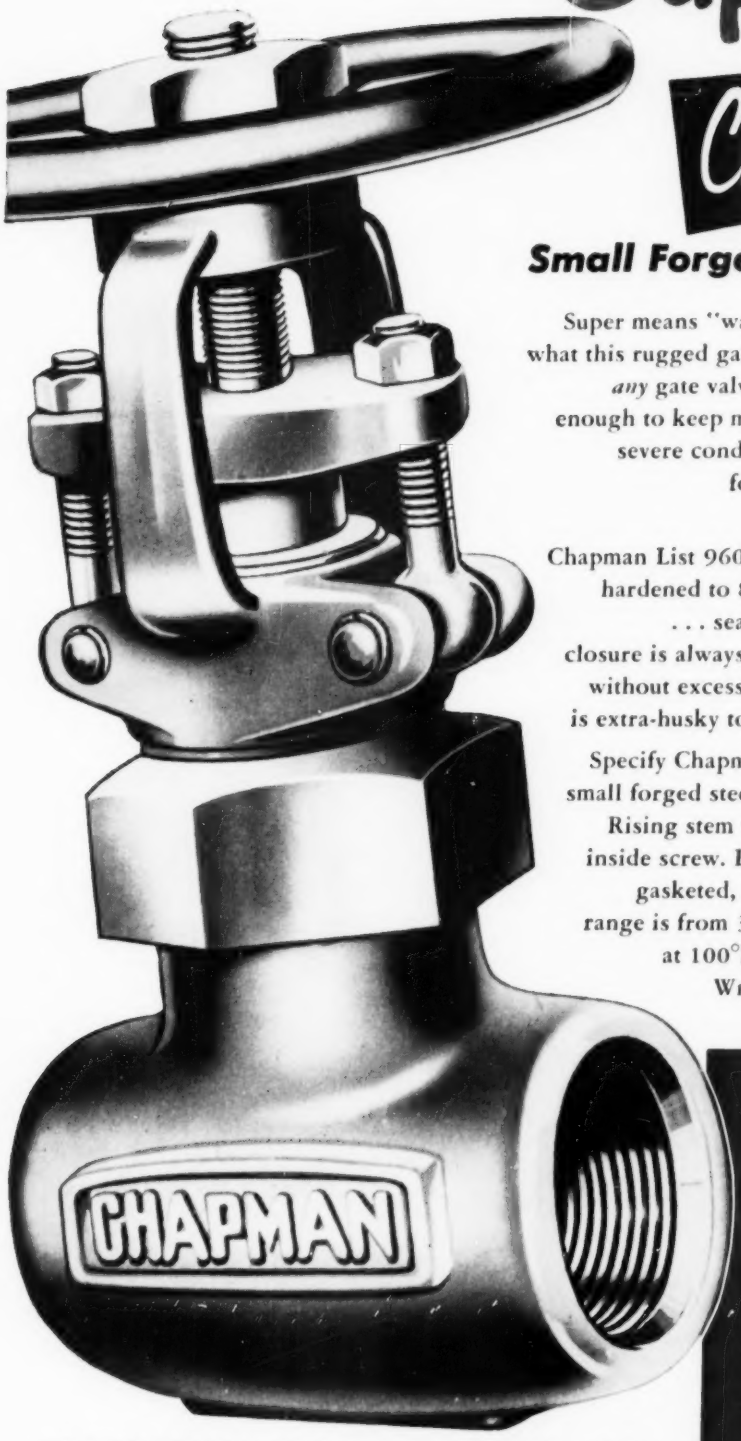

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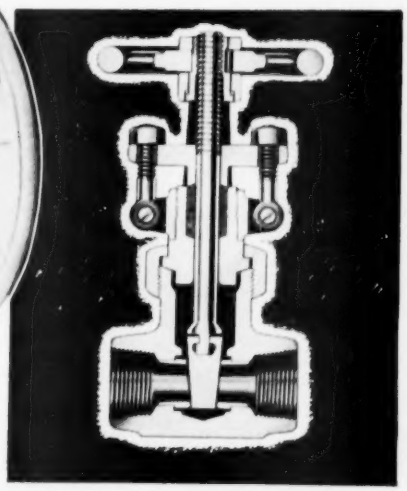

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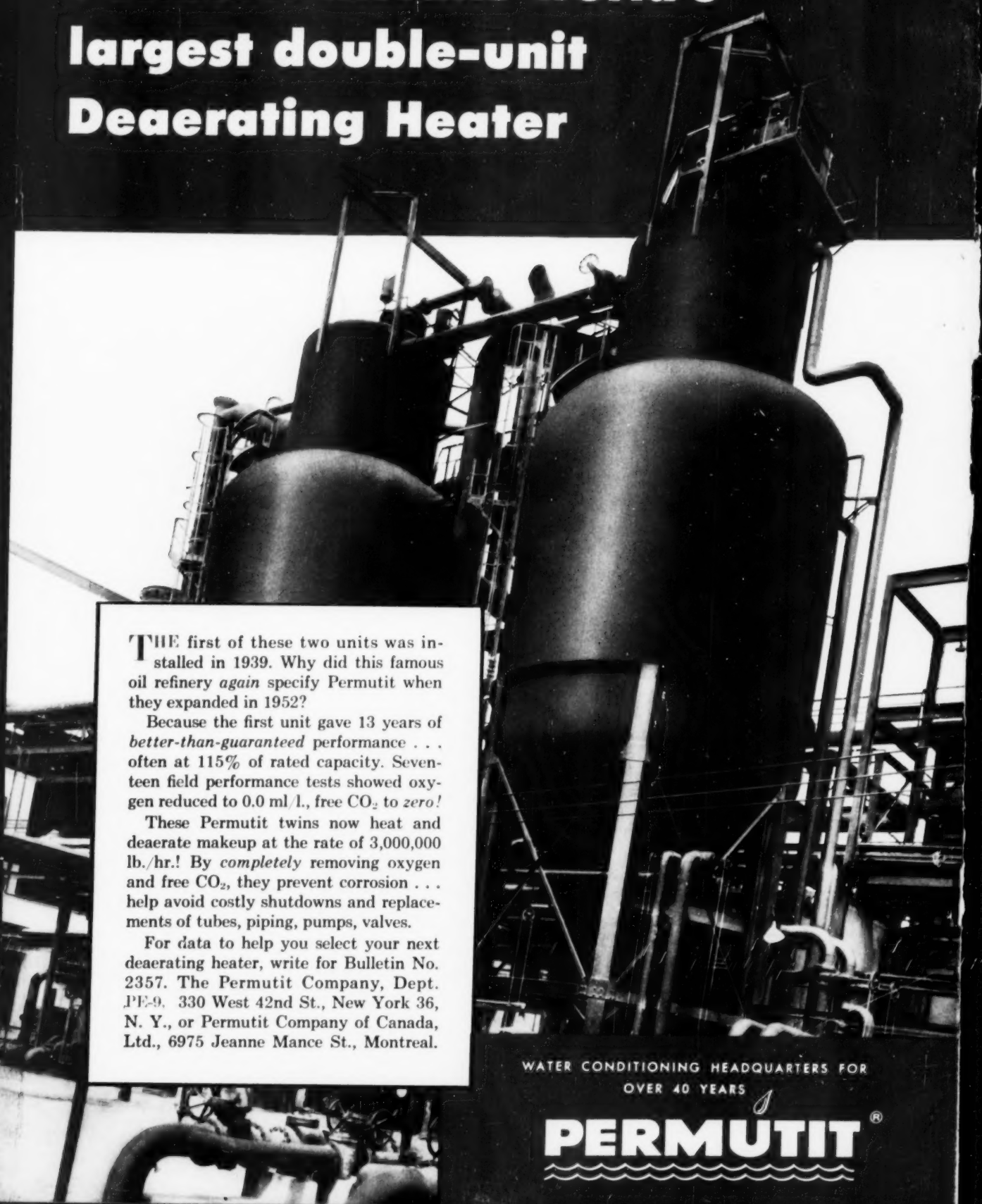

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